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AERODYNAMIC HEATING COMPUTATIONS FOR  
PROJECTILES - VOL. III: BRL  
INTERACTIVE PLOTTING  
PROGRAM (BRLINPLOT)

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)  This report describes the development of an interactive plotting and grid generation program for generating input data for the ABRES Shape Change Code. The program as developed can provide grid input data for ASCC80 as well as the modified codes BRLASCC and PLNRASCC. The report contains test cases and a detailed user's guide which describes the input data required to run the code.		

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## SECTION 1

### INTRODUCTION

This report documents the BRL Interactive Plotting Program developed under the Aerodynamic Heating Computations for Projectiles program. The overall objectives of this program were threefold:

- Modify the in-depth heat conduction package to improve ASCC's capabilities to handle slender multimaterial configurations
- Extend the developments of planar ASCC modifications to predict heating of swept fin configurations to include: (a) turbulent flow on swept wings; (b) 2-D shock shape; and (c) improved in-depth heat conduction routines
- Develop an interactive computational grid developing routine to simplify the procedure for inputting body configurations and developing computational grids for ASCC

The BRLINPLOT program is described in Volume III of this report. Changes made to ASCC80 covering Objectives 1 and 2 are documented in Volumes I and II, respectively. In this document, the updated ASC Code is referred to as BRLASCC.

It has frequently been difficult to set up the internal heat conduction grids and material interfaces required in the ASC code. It often required meticulous hand plotting by the user and then several iterations with the ASC code to set up appropriate implicit and explicit grids. Therefore the purpose

of the BRLINPLOT computer program is to allow the user to iterate on the geometry interactively without running BRLASCC. Utilizing BRLINPLOT, the user can view, correct, and review the implicit and explicit grid configurations and considerably reduce the chance of user input error. Once the conduction grids are satisfactory, BRLINPLOT creates an output file of Input Table 3 to be used with BRLASCC. The user can insert this file from BRLINPLOT directly into the BRLASCC input file.

Section 2 of this report describes how to use the BRLINPLOT program. Included in the section are: (1) device definitions that must be made prior to running the program; (2) instructions for the input file; (3) a list of definitions of the interactive commands used once the user has started running the program; and (4) a sample problem illustrating the input file, the terminal session, and the resulting BRLASCC Input Table 3 file.

## SECTION 2

### INPUT AND OUTPUT

This section is devoted to a user-oriented discussion of input and output for the BRL-Interactive Plotting Program (BRLINPLOT). Section 2.1 describes the device definitions required, Section 2.2 includes a complete set of input instructions, Section 2.3 outlines the interactive commands used when running the program, and Section 2.4 presents a sample problem to demonstrate the program.

#### 2.1 DEVICE DEFINITIONS

The following device definitions must be made prior to running the BRLINPLOT Code:

- File 4 (FOR004) = Data input file
- File 7 (FOR007) = New data file generated by BRLINPLOT
- File 8 (FOR008) = Output file

An additional file will be defined interactively for output of a device independent plot file if desired by the user.

#### 2.2 INPUT INSTRUCTIONS

The input to the code consists of:

- Three title cards
- One flag card
- Input Table 3 from BRLASCC (in its entirety)

The following sections describe these three input tables.

### 2.2.1 Title Cards

The first three cards of the input file contain title information in Columns 1 through 72. The first line will be included in the new output data file (FOR007) for reference purposes.

### 2.2.2 Flag Card

This card supplies the code with program flags which indicate options to be used.

COLUMNS	FORMAT	FLAG	DEFINITION
1-5	I5	LG	Environment Flag -1 -- Flight with internally calculated trajectory +1 -- Any other environment (flight, wind tunnel, ballistic range, general, arc heater)
6-10	I5	ISS	Shape Change Flag 0 -- Shape change with transient in-depth conduction 1 -- Shape change with steady-state in-depth conduction 2 -- No shape change
11-15	I5	IPLOTR	Device independent plot file flag 0 -- Plots will appear on terminal screen 1 -- Plots will not appear on screen but will instead be output to a file for use with a printer (the file name is defined interactively by the user)

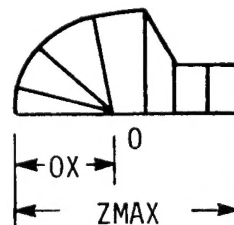
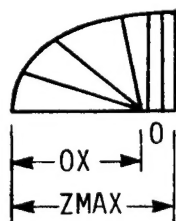
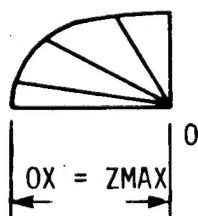
### 2.2.3 Input Table 3. Initial Configuration and In-Depth Conduction Grid Parameters

1	1- 2	I2	Enter 03 (table number)	--
2	1- 5	I5	NS -- Number of points on the heated surface of the body (maximum 50 points)	--
			>0 -- Sphere-cone shape option (applicable only for single material bodies)	
			<0 -- General shape option	

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
	6-10	I5	<u>NPN</u> -- Number of points on the nose; applicable only to sphere-cone option (NS > 0)	--
	11-15	I5	<u>MAT</u> -- Material index for single material nosetip. If the nosetip is multimaterial (maximum of six in-depth materials, general shape option only) it may be entered as zero.	--
3	1- 2		Blank	
	3-14	E12.5	<u>RNI</u> -- Initial nose radius <sup>†</sup>	Inch
	15-26	E12.5	<u>ZMAX</u> -- Maximum axial length (required input for sphere-cone option only)	Inch
			ZMAX = Z-coordinate of the last point on the sphere-cone	
	27-38	E12.5	<u>THETA</u> -- Initial cone half angle (required input for sphere-cone option only)	Deg
	39-50	E12.5	<u>OX</u> -- Axial position of the origin of the rays	Inch
			<0 -- Flat back option	
			>0 -- Plug option	

3

The following sketches illustrate the nosetip configuration/location of the origin of the ray's combination which are referred to as flat back or plug configurations.



A2/A-4203

a. Flat back (OX = ZMAX)

b. Plug (OX < ZMAX)

<sup>†</sup>Used to estimate transition altitude (or time), and for scaling of body input information

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
	51-62	E12.5	<u>TS</u> -- Initial body temperature. This input will be overridden if surface temperature distribution is input via Table 07.	°R
	63-74	E12.5	<u>STRD</u> -- (Transient option only, ISS = 0.) Maximum surface temperature rise desired between time steps. If it is less than 49°R or greater than 201°R, it is set to 75°R.	°R

- - - - - General Shape Option - - - - -

The generalized shape/interface option can be thought of as describing the boundary lines for each material in the vehicle. Each material interface should be described as a closed loop (i.e., one point should be specified twice). A simple sample will best illustrate the use of the new option. Consider a vehicle modeled by the following geometry:

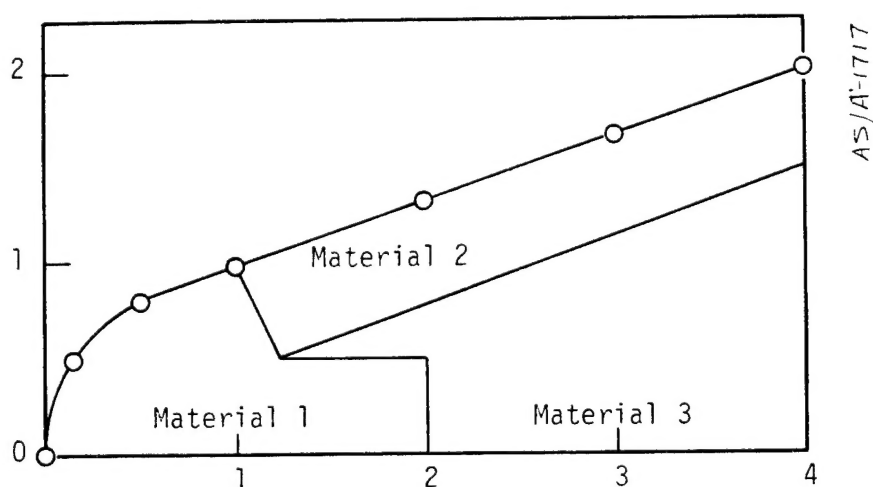


Table 3 input for this geometry is shown in Figure 1 with 10 surface points, models the interface with 22 input points, and has 1 plug point. Although the configuration appears as a flat back, the user has specified a plug option (Figure b, Page 3-14) so that the origin of rays may be placed

closer to the nosetip for better implicit layer definition. As such, the user must specify the flat back face as an unheated surface. From this data, the code will calculate the coordinates and material flags of the interface intersections with ray within the implicit layer, and the material flag indices for the explicit grid, NMAT.

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
4	1-20	F10.3,F8.3,I2	<u>ZSP(I), RSP(I), NB1(I)</u> -- For I = 1, NS. Body point coordinates and material indices for the surface of the vehicle.	Inch
			Enter one surface point per card. Enter as many cards as there are surface points (NS).	
5	1- 5	I5	<u>NIF</u> -- Number of points used to describe the interfaces	--
6	1-20	F10.3,F8.3,I2	<u>ZIS(I), RIS(I), NBS(I)</u> -- For I = 1, NIF. Coordinates and material indices for the interface locations.	Inch
			Enter one interface point per card. Enter as many cards as there are interface points (NIF).	

If the geometry consists of only one material, the interface boundary is described first by tracing the surface body points then closing the loop.

- - - - - Plug option only - - - - -

(Read only if OX > 0)

Plug points identify the remaining surface points that are not on the heated surface. Note if a flat back configuration is specified as a plug (Figure b, page 3-14), that is OX > 0, then a single plug point is required, connecting the last surface point to the axis, which describes the unheated flat back face.

## FORTRAN Coding Form

IBM

TABLE 3: INPUT GEOMETRY										FORBAIN STATEMENT										PROPERTY STATEMENT																																																																							
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
03	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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Figure 1. Sample Table 3 Input for General Shape/Interface Option

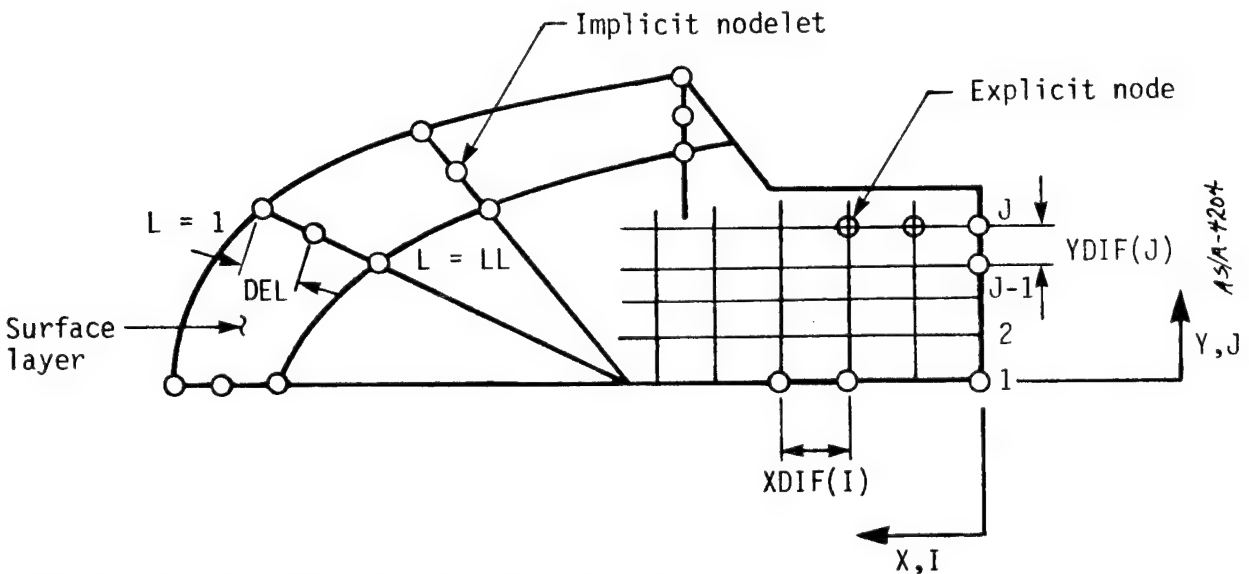


<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
5	1- 2	I2	<u>NC</u> -- Flag to read the coordinates of the body points  = 0 -- Keep reading  ≠ 0 -- Stop reading. This indicates that the card is the last of its kind.	--
	3-14	E12.5	<u>ZSP</u> -- Body point axial length, (z)	Inch
	15-26	E12.5	<u>RSP</u> -- Body point radial length, (r)	Inch

- - - - - In-depth grid setup - - - - -

(Transient option only: ISS = 0)

This in-depth grid definition and nomenclature are shown in the following sketch.



#### Comments on the Choice of the In-Depth Grid

The grid size and distribution are problem dependent. In general, there is no rule as to what the optimum value of the grid size is and one has to perform some numerical experiments to arrive at the optimum value. The acceptable solution to the problem is the one which does not change when the grid size is further refined.

In order to obtain a rough estimate of the thickness of the surface layer, we use the results of steady-state analysis of a semi-infinite solid with constant surface temperature (or heat flux) and recession rate,  $\dot{s}$ . It can be shown that the thermal penetration depth in the solid is

$$D_p = \frac{2.3\alpha}{\dot{s}}$$

where  $\alpha$  is the material thermal diffusivity and  $D_p$  is defined to be the distance from the receding surface to where the temperature drops to 10 percent of the surface temperature.

In the nosetip application, if we can estimate a characteristic recession rate,  $\dot{s}$ , we may state that the surface layer thickness should be greater than or at least equal to  $D_p$  obtained from the above formula.

For plug configuration the position of the origin of the rays on the axis of symmetry is input by the user. As a guide to determine the position of this origin, it should be noted that for accuracy of computations we desire the rays to be as close to the surface normals as possible. On the other hand, the distance OX should be large enough to allow the surface to recede without getting too close to the origin of the rays. The computations are set to stop if the distance from the back of the surface layer to the origin of the rays is anywhere smaller than DSMOVE unless the automatic shifting option is specified. In the former case, the computations can be continued by relocating the origin of the rays and using the code restart capability. The input format for the in-depth grid is as follows:

# Implicit Grid

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
6	1- 5	I2	LL -- Total number of implicit nodes (nodlets) along each ray (maximum 15)	--
7	1- 2	I2	Blank	
	3-74	6E12.5	DELN(I) -- For I=2, LL; normalized nodlet spacing (normalized distance between nodlets, from surface inwards must sum to unity; maximum of 14). If uniform spacing is desired, enter only one spacing, DELN(2); i.e., $1/(LL-1)$ = uniform spacing.	--
8	1- 2	I2	Blank	
	3-74	6E12.5	DEL(I) -- For I=1, NS; surface layer thickness along each ray. If uniform thickness is desired, enter only one thickness, DEL(1)	Inch
9	1- 5	I5	IL -- Number of explicit nodes in the X-direction (maximum 60)	--
	6-10	I5	JL -- Number of explicit nodes in the Y-direction (maximum 25)	--
10	1- 2		Blank	
	3-74	6E12.5	XDIF(I) -- For I = 2, IL (six to a card), X-direction distance between grid nodes. For uniform grid spacing in both X and Y directions enter one value only, XDIF(2)	Inch
11	1- 2		Blank	
	3-74	6E12.5	YDIF(J) -- For J = 2, JL (six to a card), Y-direction distance between grid nodes	Inch
- - - - - Trajectory calculation option only - - - - -				
(Read only if LG = -1)				

Not input for  
uniform grid spacing

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
*12	3-14	E12.5	THETAC -- Frustum angle to be used in calculating the aft body drag	Deg

<u>Card No.</u>	<u>Columns</u>	<u>Format</u>	<u>Data</u>	<u>Units</u>
15-26	E12.5	<u>RBAS</u>	-- Vehicle base radius	Inch
27-38	E12.5	<u>VLN</u>	-- Vehicle axial length	Inch
39-50	E12.5	<u>XCG</u>	-- Vehicle center of gravity location from stagnation point	Inch
51-62	E12.5	<u>WT</u>	-- Vehicle weight	lbm

### 2.3 INTERACTIVE COMMANDS

This section defines the various commands available in the BRLINPLOT program. The definitions shown below can be acquired by using the "HELP" command.

Commands available (Note: Commands must be input in capital letters):

PSUR	PIMP	PEXP	PINT	PALL	MSUR
MIMP	MEXP	MINT	ZOOM	HELP	SAVE
UPDT	NOPR	PRMT	HALT		

Modification options available:

S	P	R	C	I	D
---	---	---	---	---	---

Command PSUR:  
Plots the surface points

Command PIMP:  
Plots the implicit grid

Command PEXP:  
Plots the explicit grid nodes and shows which nodes lie in the implicit grid

Command PINT:  
Plots the interface points which were input using the general interface option

Command PIMP:  
Plots the implicit grid

Command PALL:  
Plots the explicit grid nodes, the material interface points,  
and the upper and lower bounds of the implicit grid

Command MSUR:  
Displays and modifies variables associated with the surface  
points

WARNING

Variables in this routine may be affected by  
changes in the implicit grid.

Command MIMP:  
Displays and modifies variables associated  
with the implicit grid

WARNING

Variables in this routine may be affected by  
changes in the surface points.

Command MEXP:  
Displays and modifies variables associated with the explicit  
grid

Command MINT:  
Displays and modifies variables associated with the general  
interface option

Command ZOOM:  
Rescales the window for better resolution. The routine will  
prompt for the new window coordinates. User must enter all  
four parameters (inches)

Command HELP:  
Provides a short list of commands/options and allows the user  
to access information concerning the use of these commands

Command SAVE:  
Punches and prints the modified input data

Command UPDT:  
Updates the variables used by the plotting routines using any  
modifications to the data

Command NOPR:  
Turns off the command prompting

Command PRMT:  
Turns on the command prompting

Command HALT:  
Halts execution of the code

Option S => SHOW:  
Displays the variables associated with the current modification routine

Option P => PLOT:  
Updates and plots the changes made in the current modification routine

Option R => RETURN:  
Returns to the control program

Option C => CHANGE:  
Changes the specified variable

Syntax: C VAR LOC VALUE  
where: C => CHANGE option  
VAR => Variable to be modified  
LOC => The array index to be modified for nonarray variables (enter 1 for nonarray variables)  
VALUE => The new value to be stored in VAR(LOC)

Option I => INSERT:  
Inserts values into the specified array

Syntax: I VAR LOC  
where: I => INSERT Option  
VAR => Variable to be modified. In the surface and general interface routines, "all" may be entered to insert values in all arrays  
LOC => The location in VAR after which the insertion will be made

The modification routines will prompt for the values to be inserted. If "ALL" is specified as VAR, the variables which reflect the number of entries in the arrays will also be modified.

Enter "Q" to quit inserting new values.

Option D => DELETE:  
Deletes values in the specified array

Syntax: D VAR ISRT ISTOP  
where: D => DELETE option  
VAR => Variable to be modified. In the surface and general interface routines, "ALL" may be entered to delete values in all arrays.

ISRT => The first array index in VAR  
to be deleted.  
ISTOP => The last array index in VAR  
to be deleted.

If "ALL" is specified as VAR, the variables which reflect the  
number of entries in the arrays will also be modified.

## 2.4 SAMPLE PROBLEM

This section demonstrates the versatility of the BRLINPLOT program. A  
sample nosetip geometry is input, modified, and a new geometry table is  
produced. First, a listing of the input data is shown in subsection 2.4.1,  
then a "photo" of the complete terminal session is in subsection 2.4.2, and  
finally, a listing of the new geometry table, ready for inclusion in the  
BRLASCC input file is shown in subsection 2.4.3.

## 2.4.1 Input File Listing

```

BRL FLIGHT CASE
TRANSIENT CONDUCTION SOLUTION -- BRLASCC
12.5 DEG NOSE, 8 INCH BODY
1 0
03
-12 1
0.06 2.2 585. 200.
0.0 0.0 1
.001 .0605 1
.20 .105 1
.45 .1603 1
.7 .2157 1
1.00 .2822 1
1.249 .3375 1
1.55 .3798 1
1.9 .429 2
2.2 .4712 2
5.1 .8788 2
8.0 1.2863 2
32
0.0 0.0 1
.001 .0605 1
.20 .105 1
.45 .1603 1
.7 .2157 1
1.00 .2822 1
1.249 .3375 1
1.55 .3798 1
1.875 .425 1
1.94 .32 1
1.76 .291 1
1.76 .226 1
1.268 .1571 1
1.268 .0775 1
0.86 .0775 1
0.86 0.0 1
0.86 .0 2
0.86 .0775 2
1.76 .0775 2
1.76 .291 2
1.94 .32 2
1.875 .425 2
2.2 .4712 2
5.1 .8788 2
8.0 1.2863 2
8.0 0.0 2
0.86 0.0 2
1.268 .0775 3
1.268 .1571 3
1.76 .2157 3
1.76 .0775 3
1.268 .0775 3
03 8.0 0.0
6 12
.2
.3
44 10
0.20

```

#### 2.4.2 Terminal Session

The following subsections illustrate the actions of the BRLINPLOT user at the terminal. First, after the input/output files were defined, the program was initiated. Subsection 2.4.2.1 shows the use of the various plot commands, and subsections 2.4.2.2 through 2.4.5 illustrate the different modification techniques.

##### 2.4.2.1 Using the Plot Commands

The PSUR, PIMP, PEXP, PINT, PALL, and ZOOM commands are demonstrated herein. Notice that the program will only work when the commands are capitalized and spelled correctly.

```
$ ASS BRLGEOM.DAT FOR004
$ ASS BRLGEOM.OUT FOR008
$ ASS NEWGEOM.PCH FOR007
$ RUN BRLINPLOT
```

INPUT DATA HAS BEEN READ AND ALL VARIABLES ARE DEFINED

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINP	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	UPDT	NOPR	PRMT	HALT

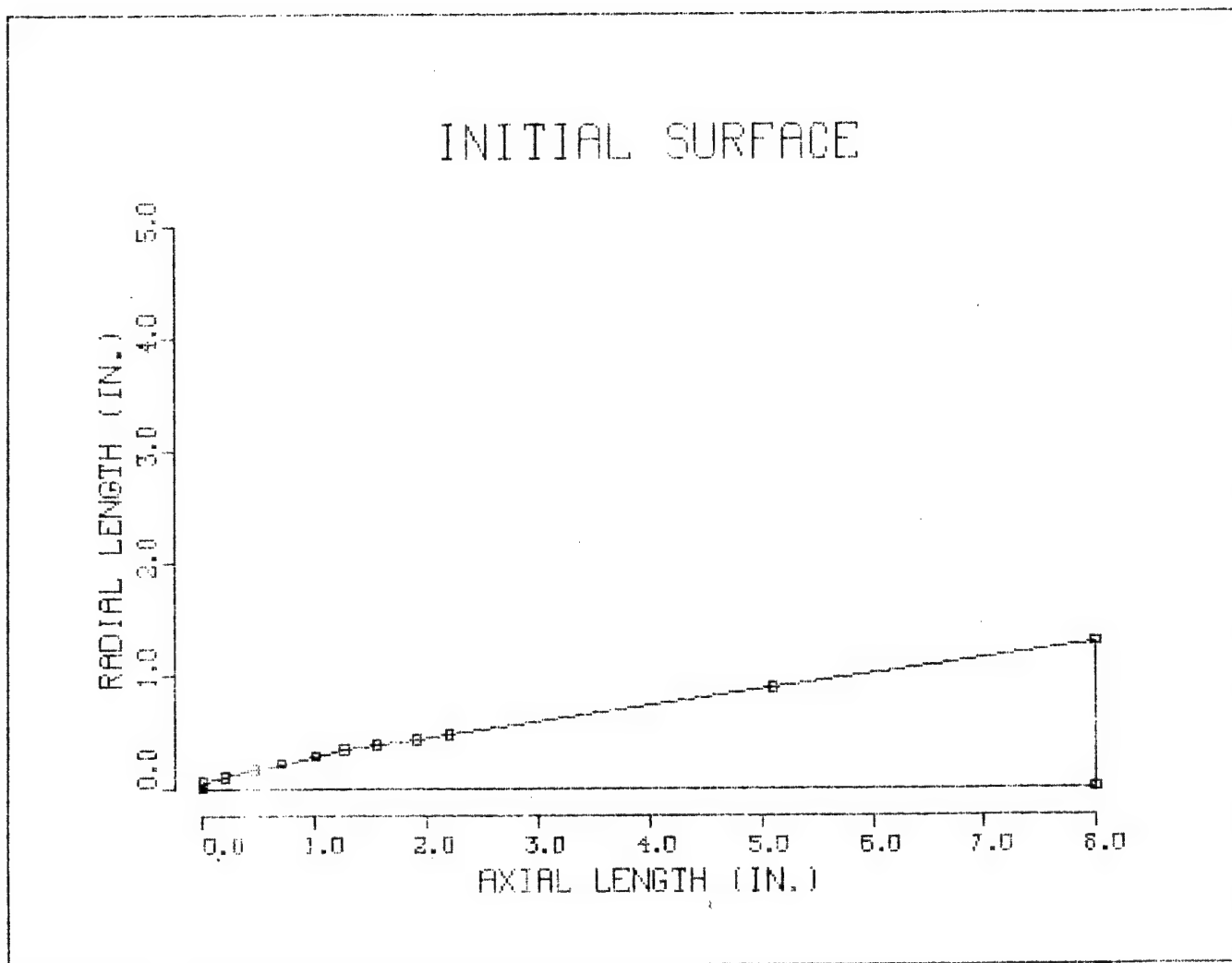
COMMAND

PUSR

INVALID COMMAND: PUSR

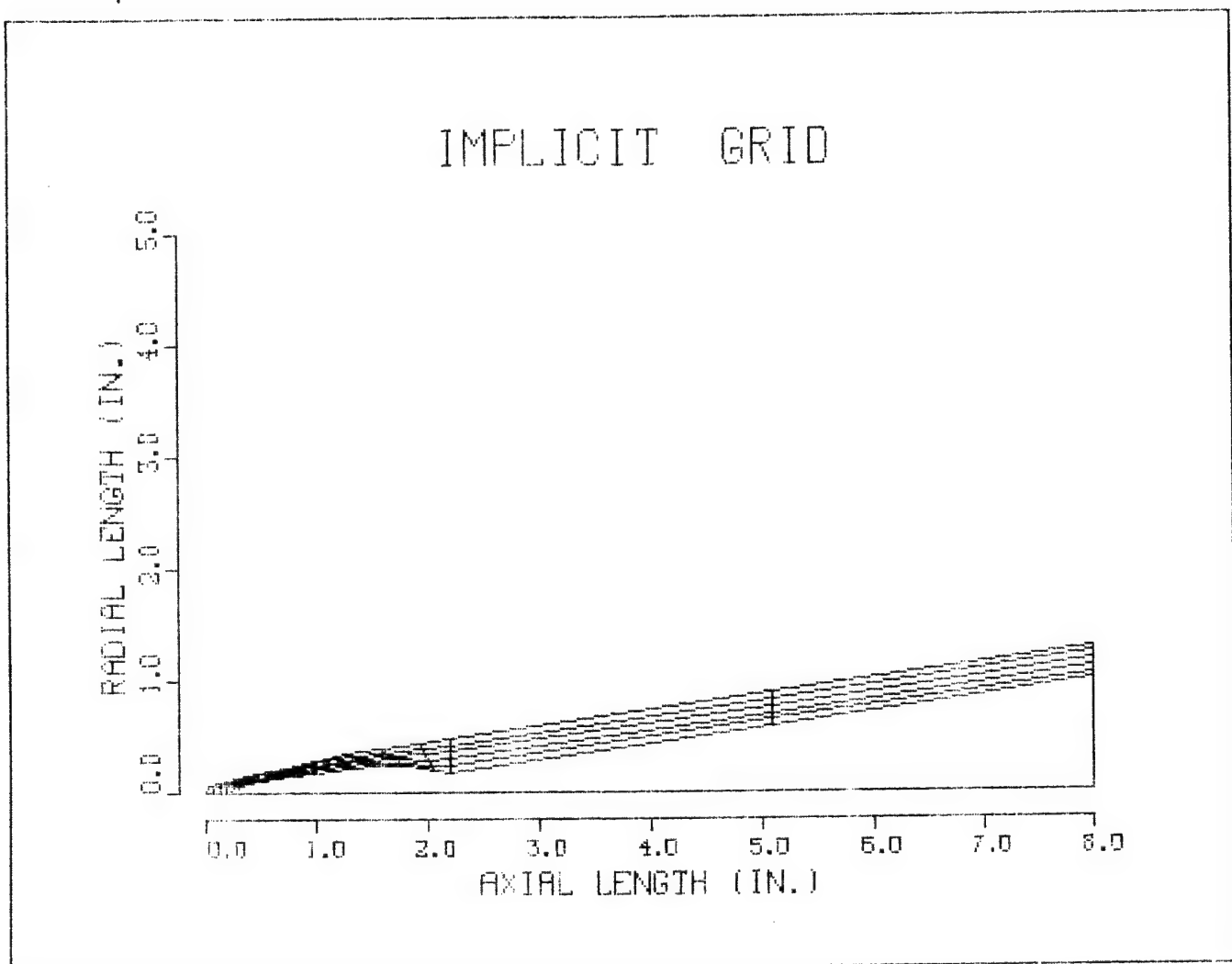
COMMAND

PSUR



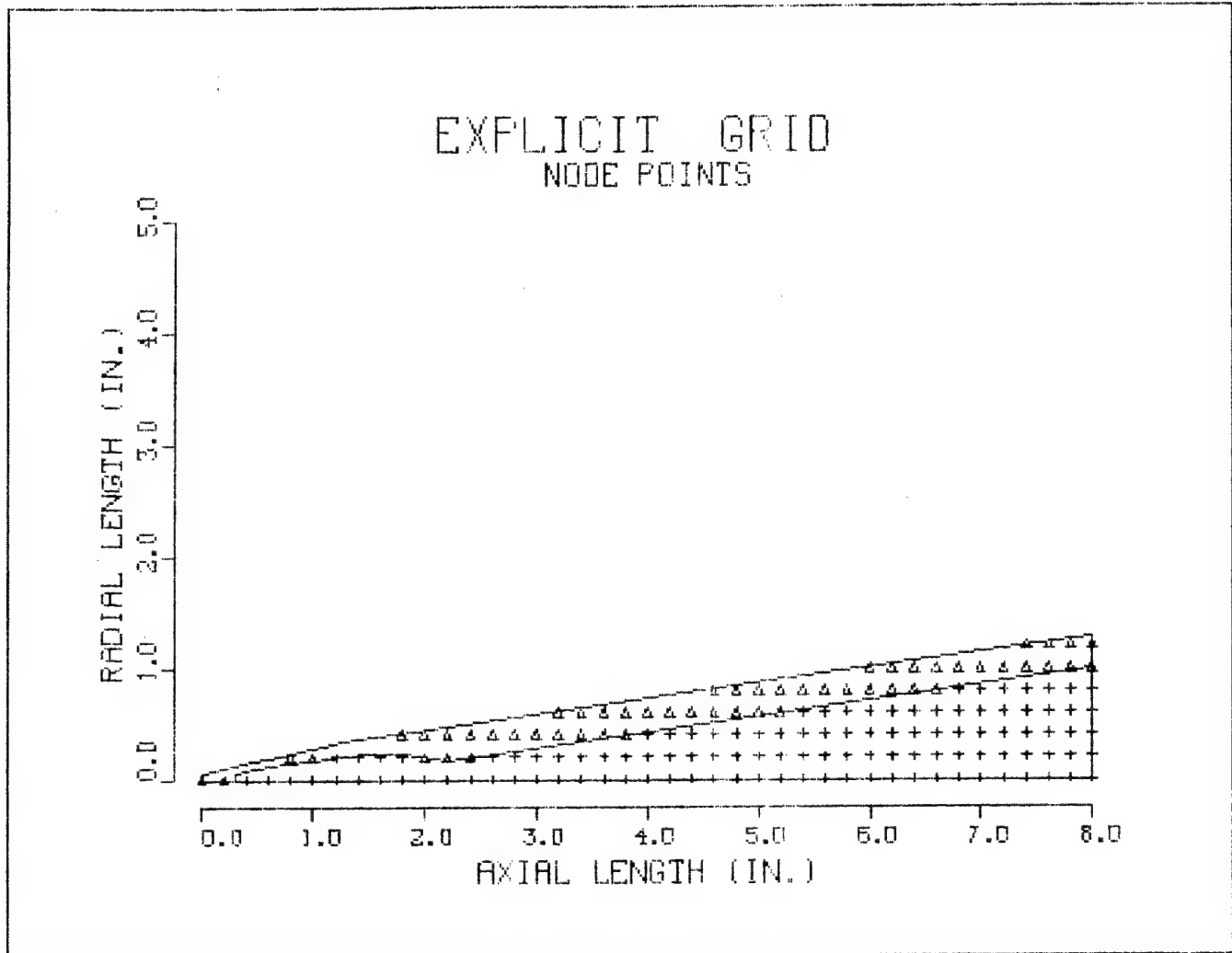
PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
MODIFY COMMANDS: MSUR MIMP MEXP MINT  
GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
PIMP



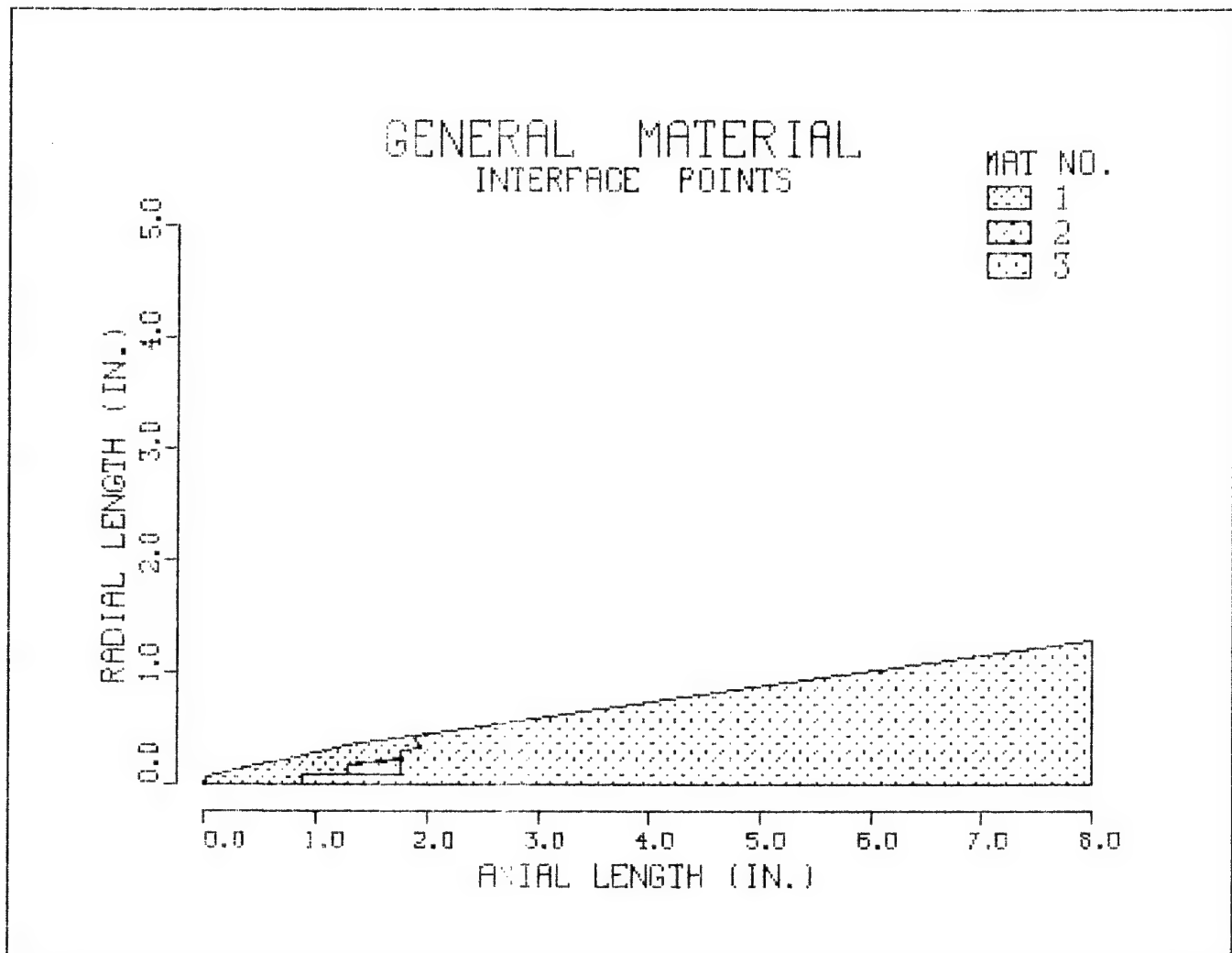
PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
MODIFY COMMANDS: MSUR MIMP MEXP MINT  
GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
PEXP



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
MODIFY COMMANDS: MSUR MIMP MEXP MINT  
GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

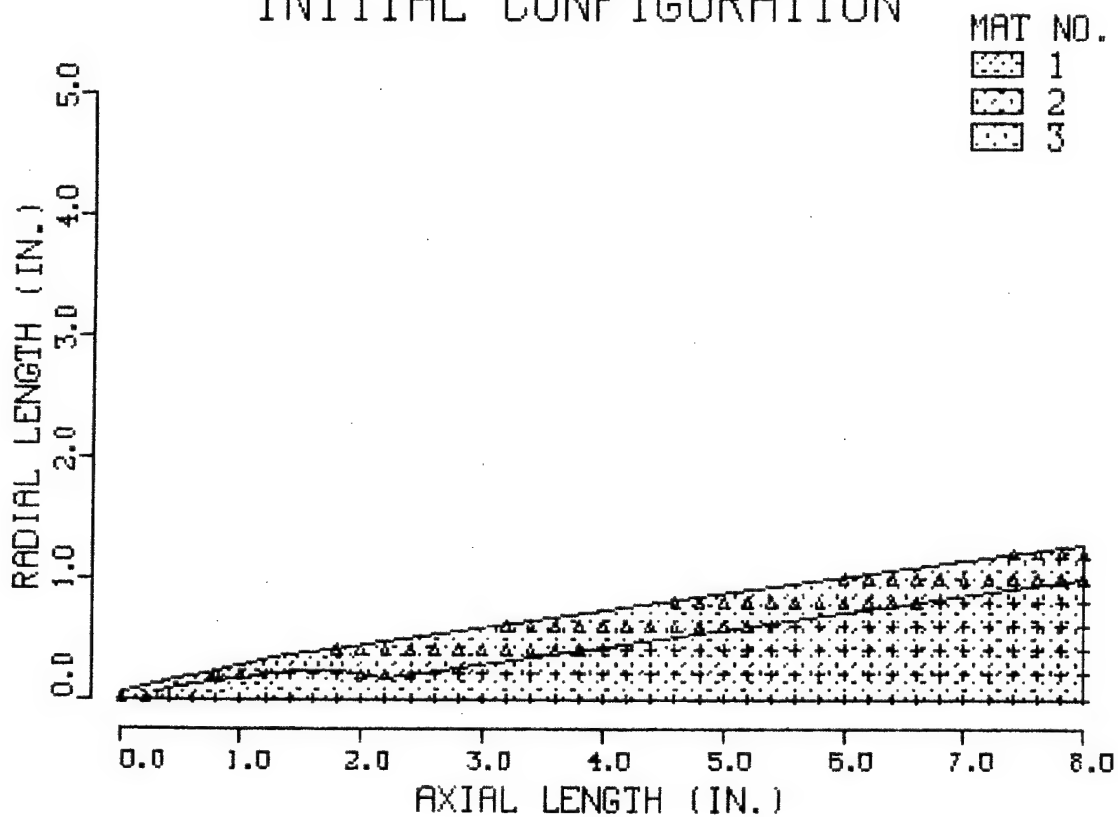
COMMAND  
PINT



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
MODIFY COMMANDS: MSUR MIMP MEXP MINT  
GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
PALL

## INITIAL CONFIGURATION



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND

ZOOM

CURRENT WINDOW COORDINATES ARE:

ZLEFT= 0.00 ZRITE= 8.00 RBOT= 0.00 RTOP= 2.66

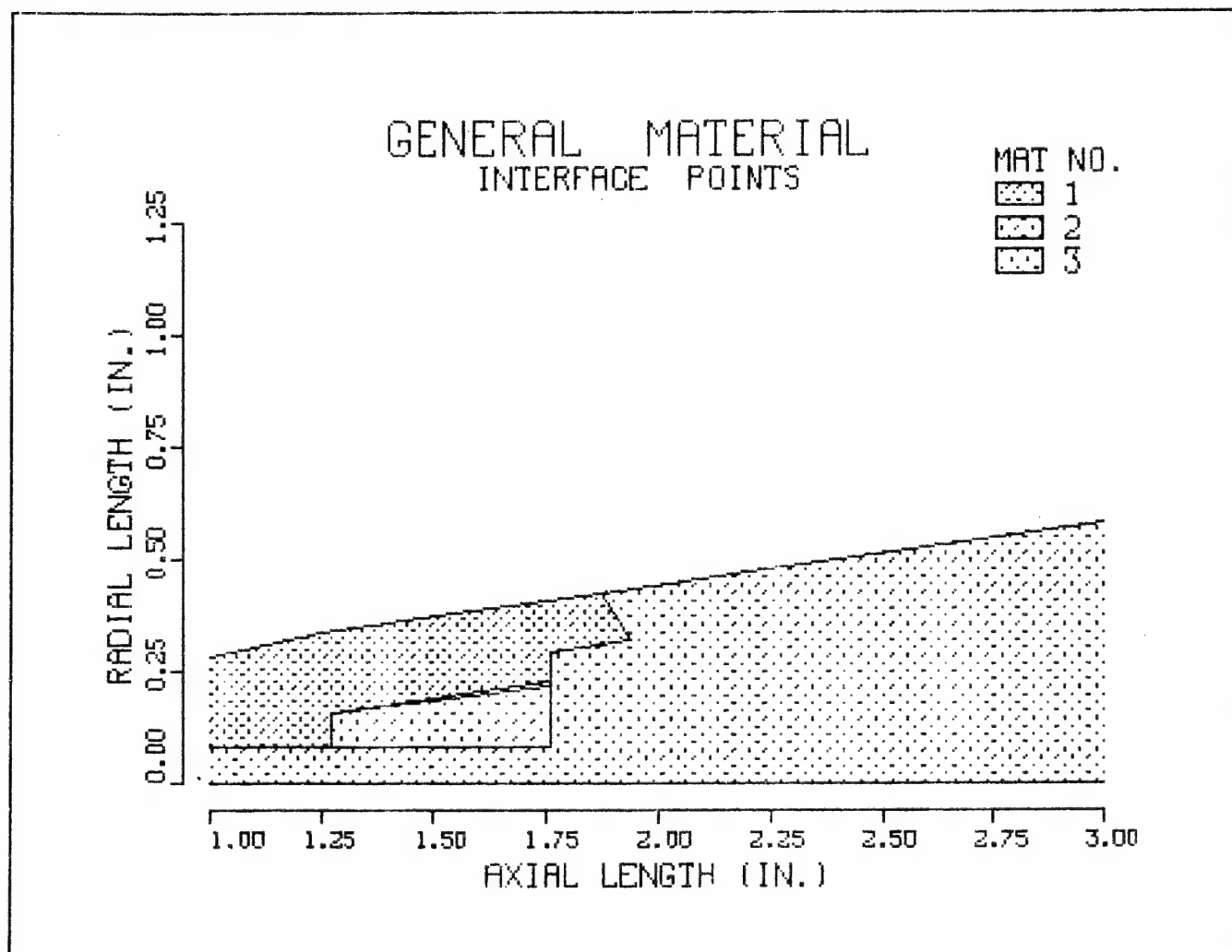
ENTER NEW COORDINATES

1.0 3.0 0.0 1.0

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND

PINT



#### 2.4.2.2 Modifying the Surface Shape

The various modify commands Show, Plot, Change, Insert, Delte, and Return are shown next. The MSUR command was used to get into the modification level. The original body shape input was listed using S, and then plotted (in the ZOOMed coordinate system) using P. Next, C, was used to change the location of point 8 and the new shape was plotted. An additional point was added after point 8 and this shape was listed and plotted. Finally point 8 was deleted with the resulting shape listed and plotted.

The user then returned to the command level using R, and changed the "window" of the plot using ZOOM.

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 MSUR

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW                      P => PLOT                      R => RETURN  
 C => CHANGE                    I => INSERT                    D => DELETE  
 H => HELP

MODIFY:

S

CONTROL VARIABLES: ISS = 0    0 => TRANSIENT CONDUCTION  
                                   1 => STEADY STATE COND.  
                                   2 => BOUNDARY LAYER  
                                   INOPT = 1    0 => ASCC77 INTERFACE FORMAT  
     1 => ASCC80 INTERFACE FORMAT  
 INTEGER VARIABLES: KLF =14    NO. OF POINTS INCLUDING PLUG  
                                   NS =-12    NO. OF SURFACE POINTS  
                                   NPN = 0    NO. OF POINTS ON NOSETIP  
                                   MAT = 0    MATERIAL NUMBER

REAL VARIABLES: RNI = 0.06 INITIAL NOSE RADIUS  
                   THETA = 0.00 INITIAL CONE HALF ANGLE  
                   ZMAX = 0.00 MAX. VEHICLE LENGTH  
                   STRD =200.0 MAX. TEMPERATURE RISE  
                   TS = 585. INITIAL SURFACE TEMP.

GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N	RSP	ZSP	NB1	RI1	ZI1	NB2	RI2	ZI2	NB3
1	0.0000	0.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
2	0.0605	0.0010	1	0.0000	0.0000	0	0.0000	0.0000	0
3	0.1050	0.2000	1	0.0000	0.0000	0	0.0000	0.0000	0
4	0.1603	0.4500	1	0.0000	0.0000	0	0.0000	0.0000	0
5	0.2157	0.7000	1	0.0000	0.0000	0	0.0000	0.0000	0
6	0.2822	1.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
7	0.3375	1.2490	1	0.0000	0.0000	0	0.0000	0.0000	0
8	0.3798	1.5500	1	0.0000	0.0000	0	0.0000	0.0000	0
9	0.4290	1.9000	2	0.0000	0.0000	0	0.0000	0.0000	0
10	0.4712	2.2000	2	0.0000	0.0000	0	0.0000	0.0000	0
11	0.8788	5.1000	2	0.0000	0.0000	0	0.0000	0.0000	0
12	1.2863	8.0000	2	0.0000	0.0000	0	0.0000	0.0000	0

POINTS ON THE PLUG

14    0.0000    8.0000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS:

S => SHOW

P => PLOT

R => RETURN

C => CHANGE

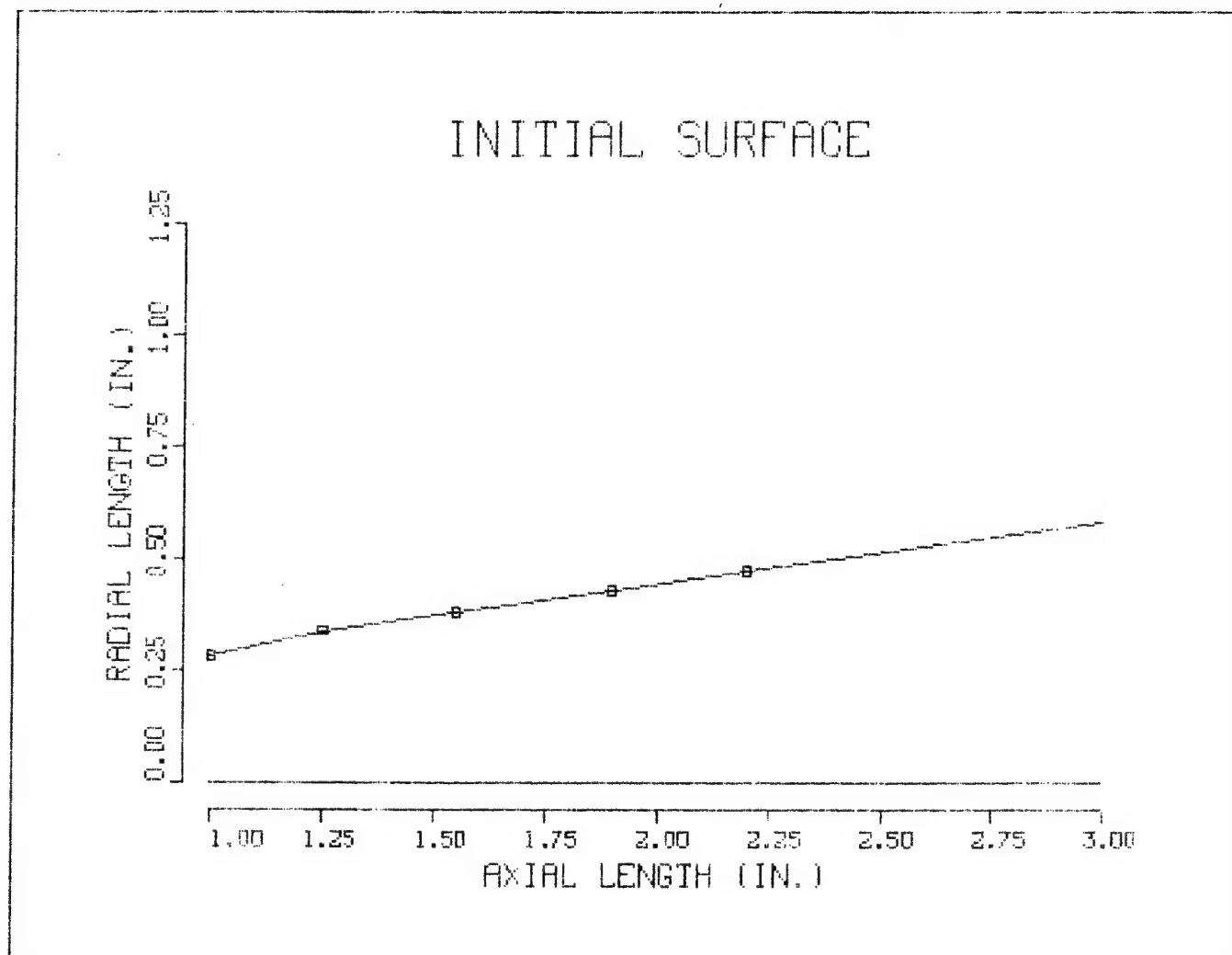
I => INSERT

D => DELETE

H => HELP

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

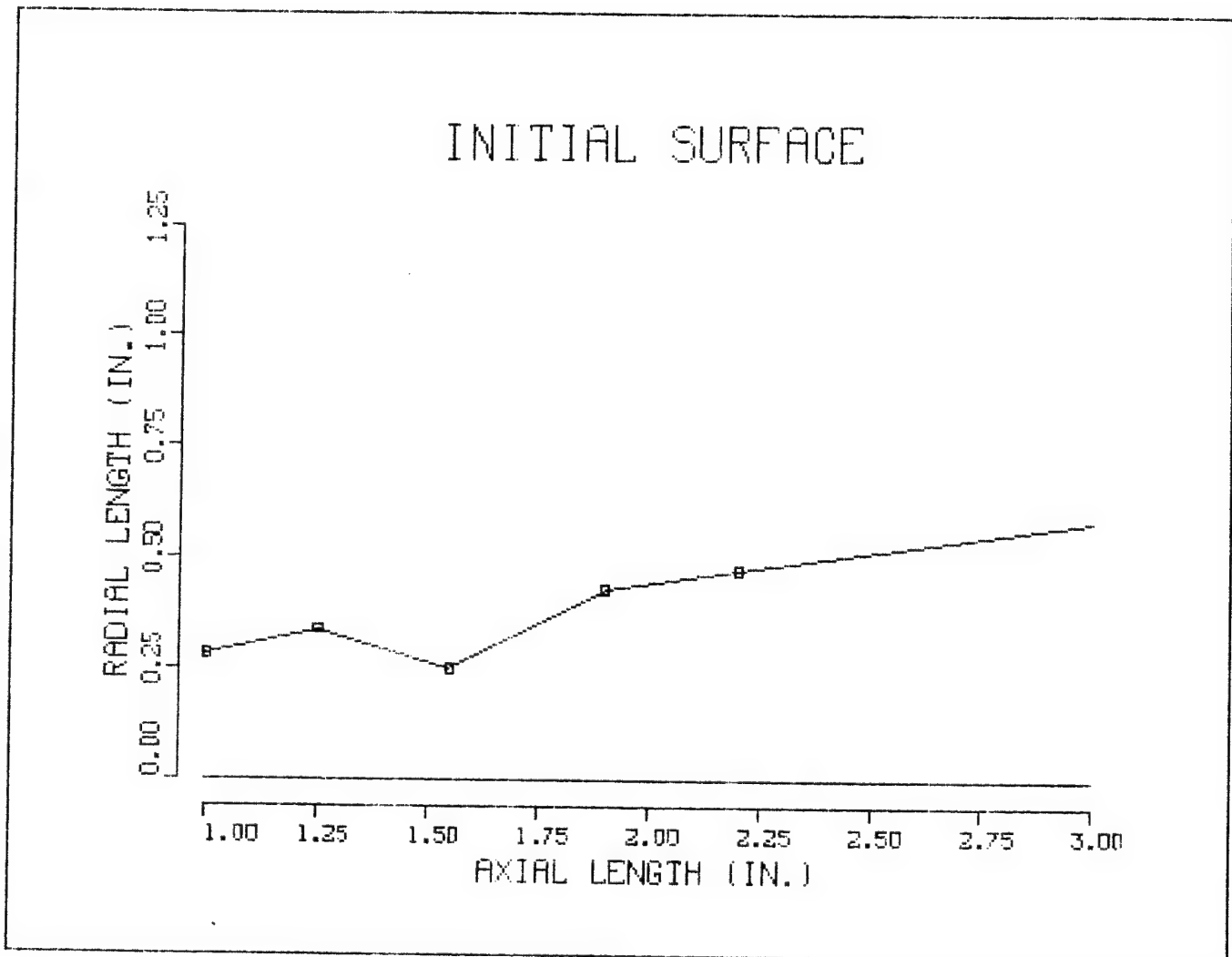
C RSP 8 0.25

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:

1 ALL 8

ENTER VALUES FOR RSP, ZSP, AND NB1 AT POINT 9

0.3798 1.55 1

ENTER VALUES FOR RSP, ZSP, AND NB1 AT POINT 10

0

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:

S

CONTROL VARIABLES; ISS = 0    0 => TRANSIENT CONDUCTION

1 => STEADY STATE COND.

2 => BOUNDARY LAYER

INOPT = 1    0 => ASCC77 INTERFACE FORMAT

1 => ASCC80 INTERFACE FORMAT

INTEGER VARIABLES: KLF =15    NO. OF POINTS INCLUDING PLUG

NS =-13    NO. OF SURFACE POINTS

NPN = 0    NO. OF POINTS ON NOSETIP

MAT = 0    MATERIAL NUMBER

REAL VARIABLES: RNI = 0.06 INITIAL NOSE RADIUS

THETA = 0.00 INITIAL CONE HALF ANGLE

ZMAX = 0.00 MAX. VEHICLE LENGTH

STRD =200.0 MAX. TEMPERATURE RISE

TS = 585. INITIAL SURFACE TEMP.

GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N	RSP	ZSP	NB1	RI1	ZI1	NB2	RI2	ZI2	NB3
1	0.0000	0.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
2	0.0605	0.0010	1	0.0000	0.0000	0	0.0000	0.0000	0
3	0.1050	0.2000	1	0.0000	0.0000	0	0.0000	0.0000	0
4	0.1603	0.4500	1	0.0000	0.0000	0	0.0000	0.0000	0
5	0.2157	0.7000	1	0.0000	0.0000	0	0.0000	0.0000	0
6	0.2822	1.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
7	0.3375	1.2490	1	0.0000	0.0000	0	0.0000	0.0000	0
8	0.2500	1.5500	1	0.0000	0.0000	0	0.0000	0.0000	0
9	0.3798	1.5500	1	0.0000	0.0000	0	0.0000	0.0000	0
10	0.4290	1.9000	2	0.0000	0.0000	0	0.0000	0.0000	0
11	0.4712	2.2000	2	0.0000	0.0000	0	0.0000	0.0000	0
12	0.8788	5.1000	2	0.0000	0.0000	0	0.0000	0.0000	0
13	1.2863	8.0000	2	0.0000	0.0000	0	0.0000	0.0000	0

POINTS ON THE PLUG

15    0.0000    8.0000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW

P => PLOT

R => RETURN

C => CHANGE

I => INSERT

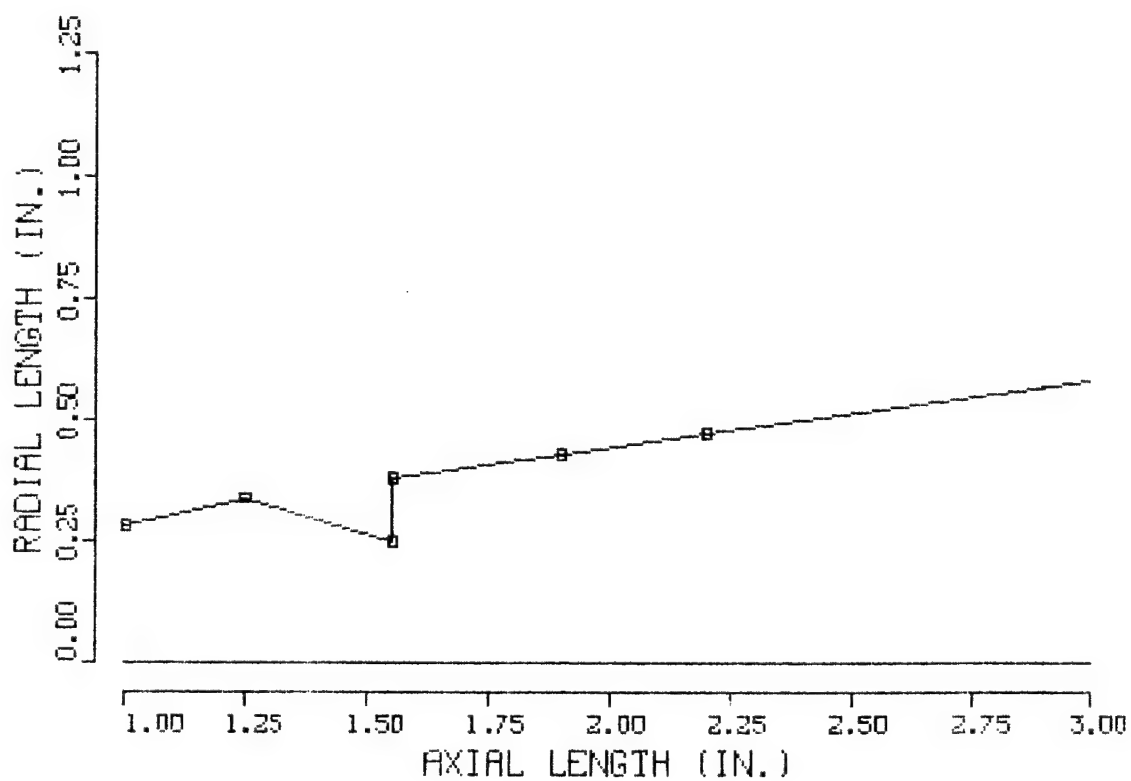
D => DELETE

H => HELP

MODIFY:

P

# INITIAL SURFACE



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

D ALL 8 8

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

CONTROL VARIABLES: ISS = 0 0 => TRANSIENT CONDUCTION

1 => STEADY STATE COND.

2 => BOUNDARY LAYER

INOPT = 1 0 => ASCC77 INTERFACE FORMAT

1 => ASCC80 INTERFACE FORMAT

INTEGER VARIABLES: KLF =14 NO. OF POINTS INCLUDING PLUG

NS =-12 NO. OF SURFACE POINTS

NPN = 0 NO. OF POINTS ON NOSETIP

MAT = 0 MATERIAL NUMBER

REAL VARIABLES: RNI = 0.06 INITIAL NOSE RADIUS

THETA = 0.00 INITIAL CONE HALF ANGLE

ZMAX = 0.00 MAX. VEHICLE LENGTH

STRD = 200.0 MAX. TEMPERATURE RISE

TS = 585. INITIAL SURFACE TEMP.

GENERALIZED GEOMETRY WITH GENERALIZED INTERFACE FORMAT

SURFACE POINTS:

N	RSP	ZSP	NB1	RI1	ZI1	NB2	RI2	ZI2	NB3
1	0.0000	0.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
2	0.0605	0.0010	1	0.0000	0.0000	0	0.0000	0.0000	0
3	0.1050	0.2000	1	0.0000	0.0000	0	0.0000	0.0000	0
4	0.1603	0.4500	1	0.0000	0.0000	0	0.0000	0.0000	0
5	0.2157	0.7000	1	0.0000	0.0000	0	0.0000	0.0000	0
6	0.2822	1.0000	1	0.0000	0.0000	0	0.0000	0.0000	0
7	0.3375	1.2490	1	0.0000	0.0000	0	0.0000	0.0000	0
8	0.3798	1.5500	1	0.0000	0.0000	0	0.0000	0.0000	0
9	0.4290	1.9000	2	0.0000	0.0000	0	0.0000	0.0000	0
10	0.4712	2.2000	2	0.0000	0.0000	0	0.0000	0.0000	0
11	0.8788	5.1000	2	0.0000	0.0000	0	0.0000	0.0000	0
12	1.2863	8.0000	2	0.0000	0.0000	0	0.0000	0.0000	0

POINTS ON THE PLUG

14 0.0000 8.0000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

R

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINT	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	NOPR	PRMT	HALT	

COMMAND

ZOOM

CURRENT WINDOW COORDINATES ARE:

ZLEFT= 1.00 ZRITE= 3.00 RBOT= 0.00 RTOP= 1.00

ENTER NEW COORDINATES

0.0 4.0 0.0 1.0

#### 2.4.2.3 Modifying the Implicit Grid

In subsection 2.4.2.1, the plot of the implicit grid revealed a serious problem with the grid layout. This grid would be very unsuitable for BRLASCC's conduction calculation. It was modified at this point in the terminal session using MIMP. A listing of the important variables showed that a uniform grid was used. The variables DEL(I) I = 1, NS were changed to a nonuniform grid thickness, in order to make the grid appear uniform along the body. A uniform spacing along the rays was maintained by not defining DELN(3), and setting DELN(2) = 0.2. Notice that DELN(1) = 0. This variable is not used by BRLASCC OR BRLINPLOT. The DELN array starts at Index = 2 and ends at Index = LL.

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 MIMP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

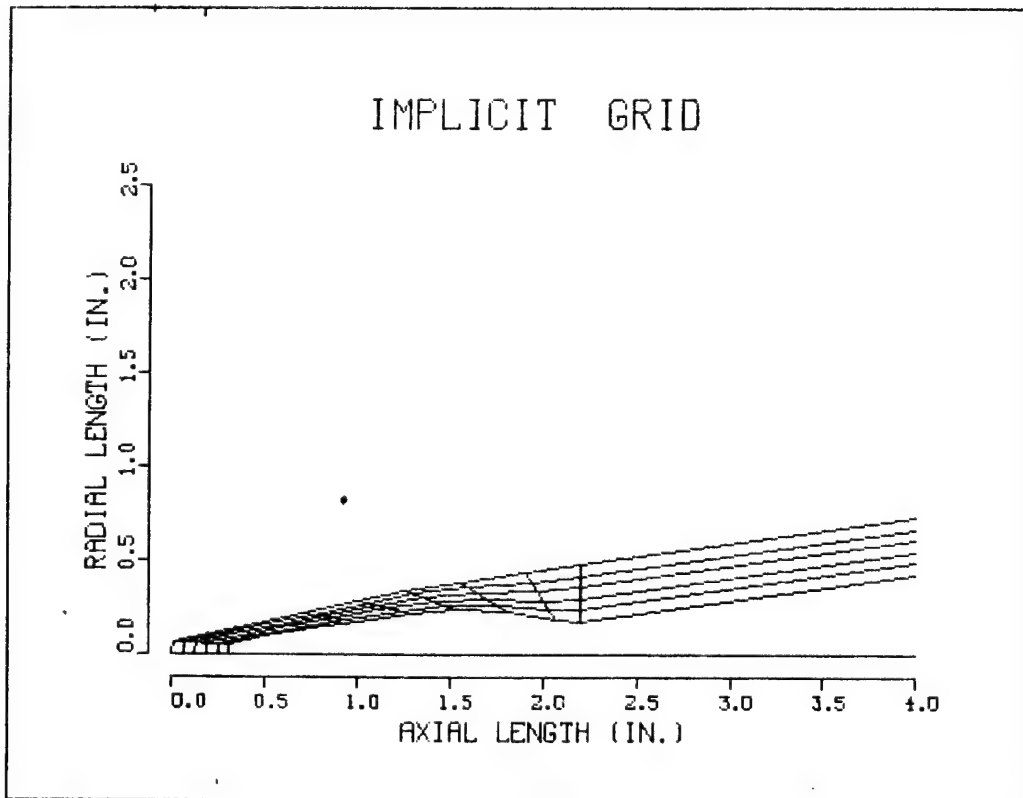
VARIABLES: NS = -12 NO. OF SURFACE POINTS  
 LL = 6 NO. OF IN-DEPTH NODLETS  
 OX = 2.20 ORIGIN OF RAYS (FROM NOSETIP)  
 UNIFORM IMPLICIT GRID: DEL = 0.30000 GRID THICKNESS  
 DELN = 0.20000 NODLET THICKNESS

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 2 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 3 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 4 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 5 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 6 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DEL 7 .3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
C DEL 8 .25

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
C DEL 9 .16

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
C DEL 10 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
C DEL 11 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
C DEL 12 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW                      P => PLOT                      R => RETURN  
C => CHANGE                    I => INSERT                    D => DELETE  
H => HELP

MODIFY:  
S  
VARIABLES: NS = -12    NO. OF SURFACE POINTS  
            LL = 6      NO. OF IN-DEPTH NODLETS  
            OX = 2.20    ORIGIN OF RAYS (FROM NOSETIP)

IMPLICIT GRID THICKNESSES AND NODLET DISTRIBUTION:

N	DEL	L	DELN
1	0.30000	1	0.00000E+00
2	0.30000		
3	0.30000		
4	0.30000		
5	0.30000		
6	0.30000		
7	0.30000		
8	0.25000		
9	0.16000		
10	0.15000		
11	0.15000		
12	0.15000		

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C DELN 2 .2

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

VARIABLES: NS = -12 NO. OF SURFACE POINTS

LL = 6 NO. OF IN-DEPTH NODLETS

OX = 2.20 ORIGIN OF RAYS (FROM NOSETIP)

IMPLICIT GRID THICKNESSES AND NODLET DISTRIBUTION:

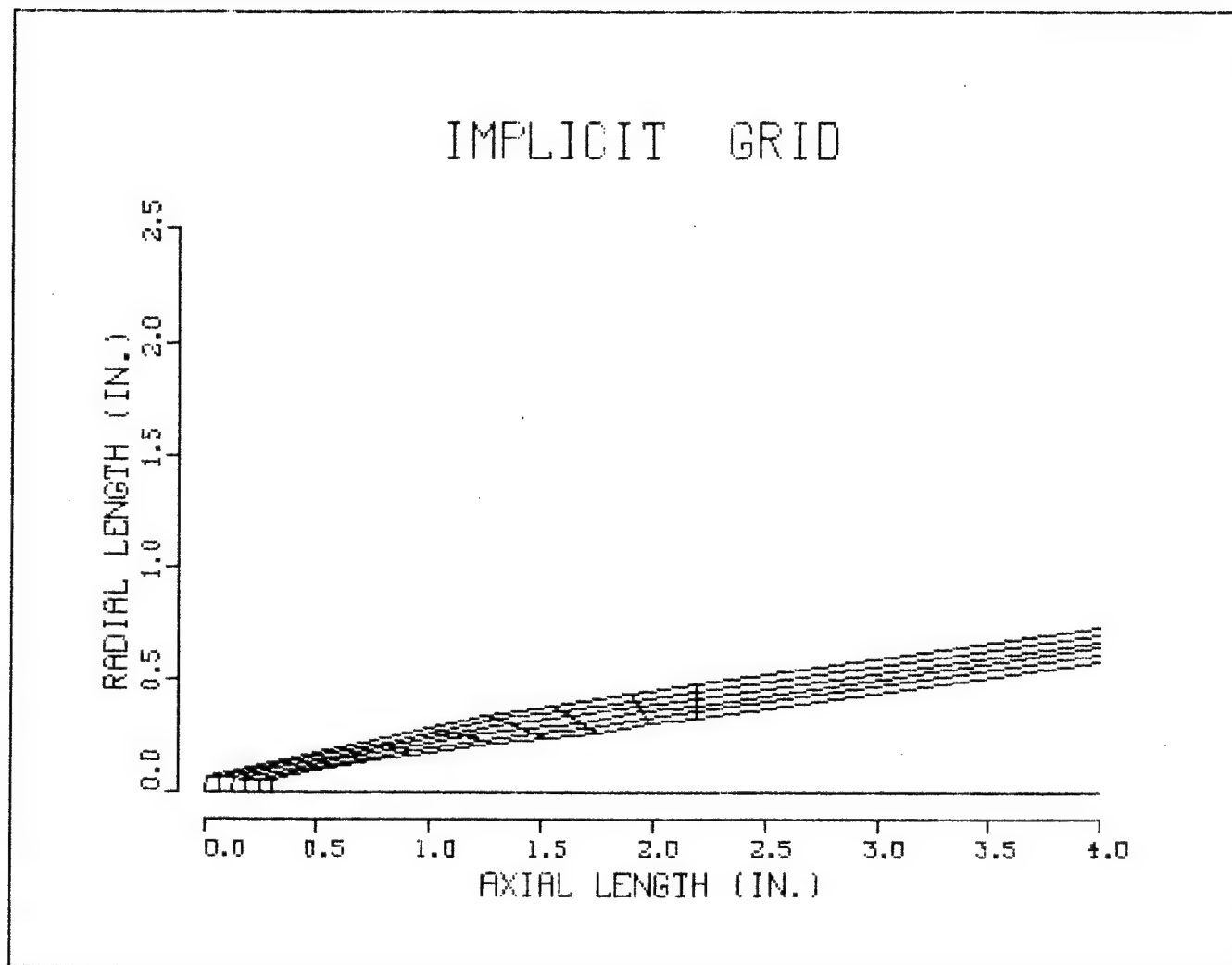
N	DEL	L	DELN
1	0.30000	1	0.00000E+00
2	0.30000		
3	0.30000		
4	0.30000		
5	0.30000		
6	0.30000		
7	0.30000		
8	0.25000		
9	0.16000		
10	0.15000		
11	0.15000		
12	0.15000		

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

R

#### 2.4.2.4 Modifying the Explicit Grid

Using PEXP, the explicit grid was modified by the user. The user thought that the uniform spacing of  $XDIF(2) = 0.2$  was too large so the grid size was reduced. The following hints are useful when modifying the explicit grid.

- If a uniform grid is desired, only  $XDIF(2)$  needs to be changed. The programs know to use uniform spacing if  $XDIF(3) = 0$ .
- If the user wants to change to a nonuniform grid, the best way is to reduce the number of grid points  $IL$  and  $JL$ , and then use the Insert method. If Insert is not used, then each and every grid point must be Changed which is more tedious for the user. (Both methods are illustrated in this subsection). As you insert values, the  $IL$  and  $JL$  counters will be updated.
- The user should make sure that there is a good overlap between the implicit and explicit grid system so that adequate boundary conditions will exist. The explicit grid points falling within the implicit grid are drawn as triangles.

Although many changes were made to the explicit grid, the user returned to a uniform grid with  $XDIF(2) = 0.15$

This was easily accomplished by setting  $XDIF(3) = 0$  and  $XDIF(2) = 0.15$ . The other  $XDIF$  values and the  $YDIF$  values did not need to be changed back.

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 MEXP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

INTEGER VARIABLES: IL =44 NO. OF AXIAL VALUES

JL =10 NO. OF RADIAL VALUES

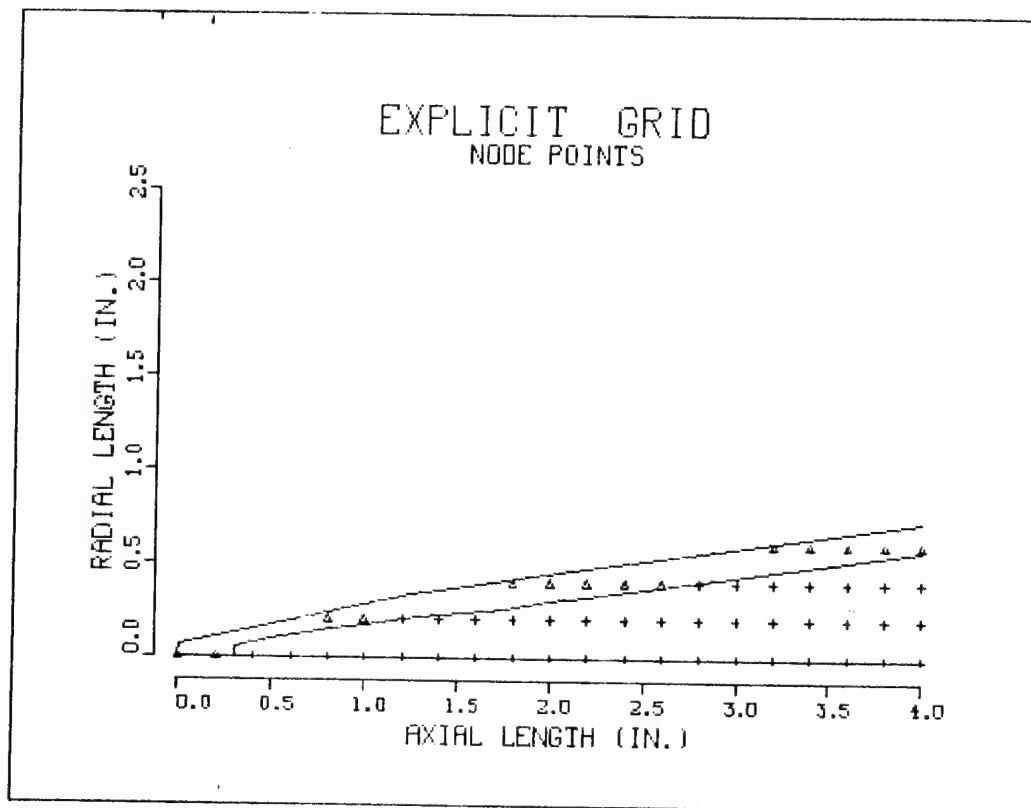
UNIFORM EXPLICIT GRID: XDIF = 0.20000 GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW            P => PLOT            R => RETURN  
C => CHANGE          I => INSERT          D => DELETE  
H => HELP

MODIFY:  
C IL 1 55

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW            P => PLOT            R => RETURN  
C => CHANGE          I => INSERT          D => DELETE  
H => HELP

MODIFY:  
C JL 1 11

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
S => SHOW            P => PLOT            R => RETURN  
C => CHANGE          I => INSERT          D => DELETE  
H => HELP

MODIFY:  
C XDIF 2 0.15

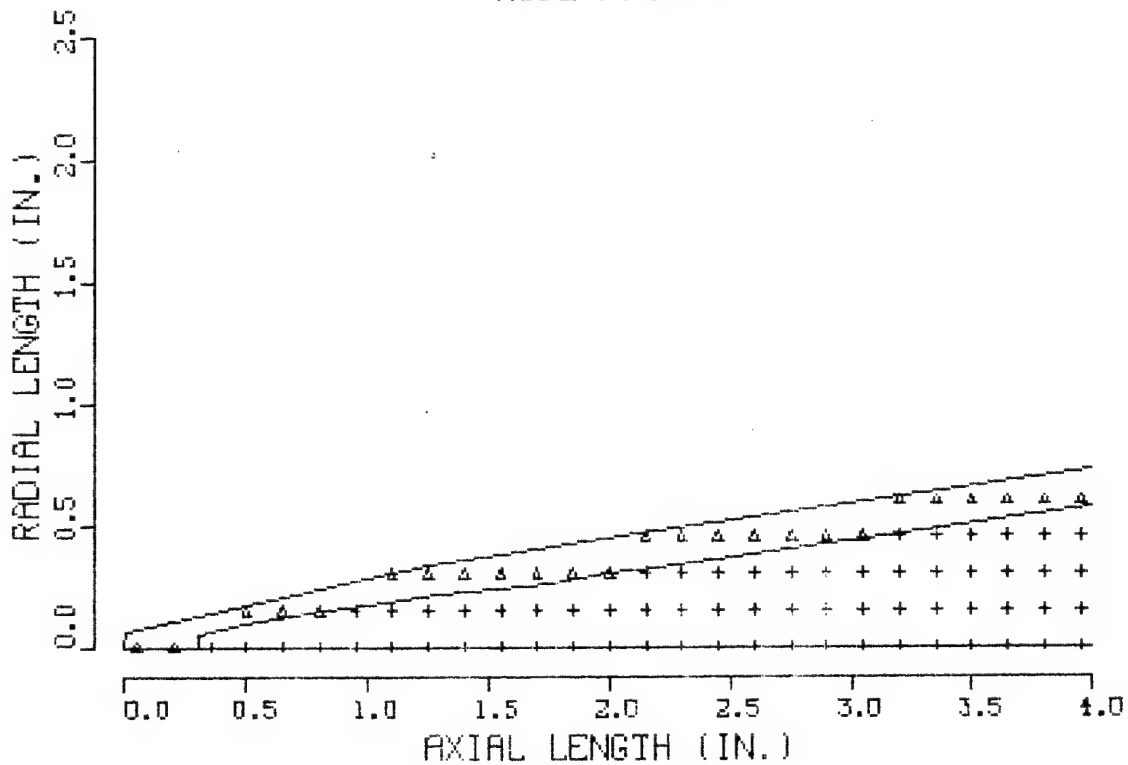
PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P

## EXPLICIT GRID NODE POINTS



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

R

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 ZOOM  
 CURRENT WINDOW COORDINATES ARE:  
 ZLEFT= 0.00 ZRITE= 4.00 RBOT= 0.00 RTOP= 1.00

ENTER NEW COORDINATES  
 0.0 8.0 0.0 2.7

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 MEXP

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW P => PLOT R => RETURN  
 C => CHANGE I => INSERT D => DELETE  
 H => HELP

MODIFY:  
 S  
 INTEGER VARIABLES: IL =55 NO. OF AXIAL VALUES  
 JL =11 NO. OF RADIAL VALUES  
 UNIFORM EXPLICIT GRID: XDIF = 0.15000 GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW P => PLOT R => RETURN  
 C => CHANGE I => INSERT D => DELETE  
 H => HELP

MODIFY:  
 C YDIF 2 .1

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW P => PLOT R => RETURN  
 C => CHANGE I => INSERT D => DELETE  
 H => HELP

MODIFY:  
 S  
 INTEGER VARIABLES: IL =55 NO. OF AXIAL VALUES  
 JL =11 NO. OF RADIAL VALUES  
 UNIFORM EXPLICIT GRID: XDIF = 0.15000 GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C XDIF 3 .1

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

INTEGER VARIABLES: IL =55 NO. OF AXIAL VALUES  
JL =11 NO. OF RADIAL VALUES

EXPLICIT GRID STEP SIZES:

I	XDIF	J	YDIF
2	0.15000	2	0.10000
3	0.10000	3	0.00000E+00
4	0.00000E+00	4	0.00000E+00
5	0.00000E+00	5	0.00000E+00
6	0.00000E+00	6	0.00000E+00
7	0.00000E+00	7	0.00000E+00
8	0.00000E+00	8	0.00000E+00
9	0.00000E+00	9	0.00000E+00
10	0.00000E+00	10	0.00000E+00
11	0.00000E+00	11	0.00000E+00
12	0.00000E+00		
13	0.00000E+00		
14	0.00000E+00		
15	0.00000E+00		
16	0.00000E+00		
17	0.00000E+00		
18	0.00000E+00		
19	0.00000E+00		
20	0.00000E+00		
21	0.00000E+00		
22	0.00000E+00		
23	0.00000E+00		
24	0.00000E+00		
25	0.00000E+00		
26	0.00000E+00		
27	0.00000E+00		
28	0.00000E+00		
29	0.00000E+00		
30	0.00000E+00		
31	0.00000E+00		
32	0.00000E+00		

33 0.00000E+00  
34 0.00000E+00  
35 0.00000E+00  
36 0.00000E+00  
37 0.00000E+00  
38 0.00000E+00  
39 0.00000E+00  
40 0.00000E+00  
41 0.00000E+00  
42 0.00000E+00  
43 0.00000E+00  
44 0.00000E+00  
45 0.00000E+00  
46 0.00000E+00  
47 0.00000E+00  
48 0.00000E+00  
49 0.00000E+00  
50 0.00000E+00  
51 0.00000E+00  
52 0.00000E+00  
53 0.00000E+00  
54 0.00000E+00  
55 0.00000E+00

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C XDIF 3 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C XDIF 4 .15

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C IL 1 4

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

INTEGER VARIABLES: IL = 4 NO. OF AXIAL VALUES  
JL = 11 NO. OF RADIAL VALUES

EXPLICIT GRID STEP SIZES:

I	XDIF	J	YDIF
2	0.15000	2	0.10000
3	0.15000	3	0.00000E+00
4	0.15000	4	0.00000E+00
		5	0.00000E+00
		6	0.00000E+00
		7	0.00000E+00
		8	0.00000E+00
		9	0.00000E+00
		10	0.00000E+00
		11	0.00000E+00

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

C JL 1 2

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

INTEGER VARIABLES: IL = 4 NO. OF AXIAL VALUES  
JL = 2 NO. OF RADIAL VALUES

EXPLICIT GRID STEP SIZES:

I	XDIF	J	YDIF
2	0.15000	2	0.10000
3	0.15000		
4	0.15000		

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

I XDIF 4

ENTER VALUE 5

.15

ENTER VALUE 6

.15

ENTER VALUE 7

.15

ENTER VALUE 8

.15

ENTER VALUE 9

.15

ENTER VALUE 10

.15

ENTER VALUE 11

.15

ENTER VALUE 12

.2

ENTER VALUE 13

.1

ENTER VALUE 14

.15

ENTER VALUE 15

.15

ENTER VALUE 16

.2

ENTER VALUE 17

.1

ENTER VALUE 18

.15

ENTER VALUE 19

.15

ENTER VALUE 20  
.2  
ENTER VALUE 21  
.15  
ENTER VALUE 22  
.1  
ENTER VALUE 23  
.15  
ENTER VALUE 24  
.15  
ENTER VALUE 25  
.2  
ENTER VALUE 26  
.1  
ENTER VALUE 27  
.15  
ENTER VALUE 28  
.15  
ENTER VALUE 29  
.15  
ENTER VALUE 30  
.2  
ENTER VALUE 31  
.1  
ENTER VALUE 32  
.15  
ENTER VALUE 33  
.15  
ENTER VALUE 34  
.2  
ENTER VALUE 35  
.1  
ENTER VALUE 36  
.15  
ENTER VALUE 37  
.15  
ENTER VALUE 38  
.2  
ENTER VALUE 39  
.1  
ENTER VALUE 40  
.2  
ENTER VALUE 41  
.1  
ENTER VALUE 42  
.2  
ENTER VALUE 43  
.1  
ENTER VALUE 44  
.2  
ENTER VALUE 45  
.1  
ENTER VALUE 46  
.2

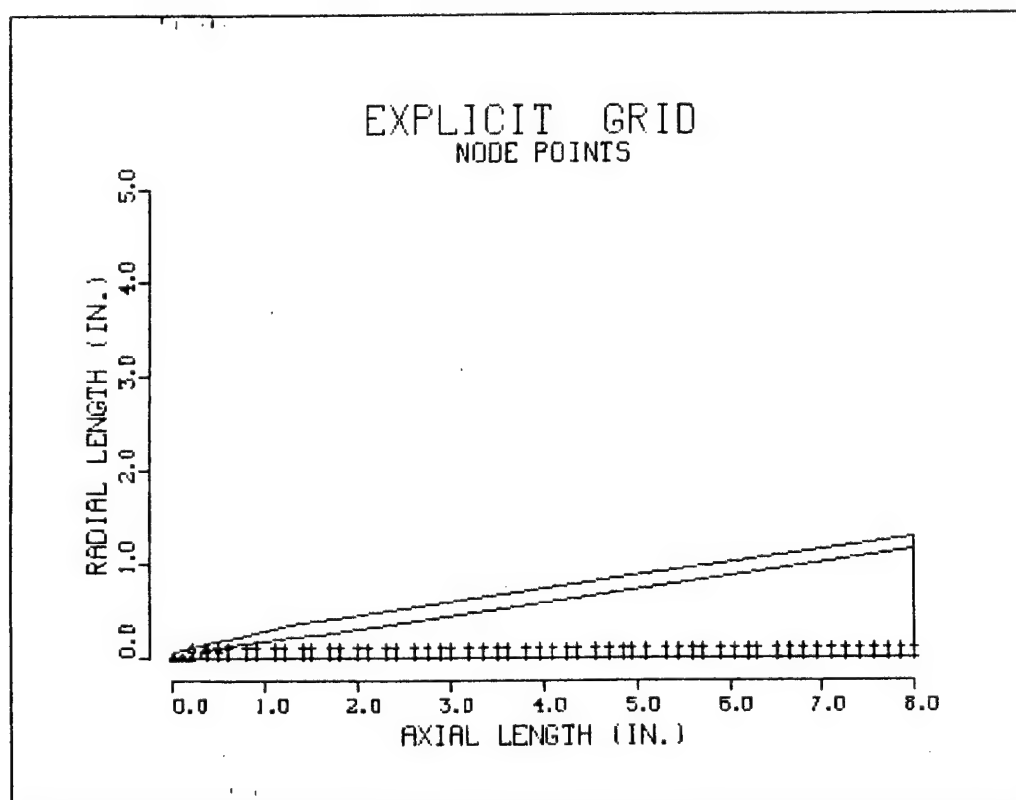
ENTER VALUE 47  
.1  
ENTER VALUE 48  
.2  
ENTER VALUE 49  
.1  
ENTER VALUE 50  
.2  
ENTER VALUE 51  
.1  
ENTER VALUE 52  
.15  
ENTER VALUE 53  
.15  
ENTER VALUE 54  
.1  
ENTER VALUE 55  
.1  
ENTER VALUE 56  
.1  
ENTER VALUE 57  
Q

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

S

INTEGER VARIABLES: IL =56 NO. OF AXIAL VALUES  
JL = 2 NO. OF RADIAL VALUES

EXPLICIT GRID STEP SIZES:

I	XDIF	J	YDIF
2	0.15000	2	0.10000
3	0.15000		
4	0.15000		
5	0.15000		
6	0.15000		
7	0.15000		
8	0.15000		
9	0.15000		
10	0.15000		
11	0.15000		
12	0.20000		
13	0.10000		
14	0.15000		
15	0.15000		
16	0.20000		
17	0.10000		
18	0.15000		
19	0.15000		
20	0.20000		
21	0.15000		
22	0.10000		
23	0.15000		
24	0.15000		
25	0.20000		
26	0.10000		
27	0.15000		
28	0.15000		
29	0.15000		
30	0.20000		
31	0.10000		
32	0.15000		
33	0.15000		
34	0.20000		
35	0.10000		
36	0.15000		
37	0.15000		
38	0.20000		
39	0.10000		
40	0.20000		
41	0.10000		

42 0.20000  
 43 0.10000  
 44 0.20000  
 45 0.10000  
 46 0.20000  
 47 0.10000  
 48 0.20000  
 49 0.10000  
 50 0.10000  
 51 0.10000  
 52 0.15000  
 53 0.15000  
 54 0.10000  
 55 0.10000  
 56 0.10000

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW            P => PLOT            R => RETURN  
 C => CHANGE          I => INSERT          D => DELETE  
 H => HELP

MODIFY:  
 C IL 1 55

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW            P => PLOT            R => RETURN  
 C => CHANGE          I => INSERT          D => DELETE  
 H => HELP

MODIFY:  
 C JL 1 11

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW            P => PLOT            R => RETURN  
 C => CHANGE          I => INSERT          D => DELETE  
 H => HELP

MODIFY:  
 C XDIF 3 0.0

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S => SHOW            P => PLOT            R => RETURN  
 C => CHANGE          I => INSERT          D => DELETE  
 H => HELP

MODIFY:

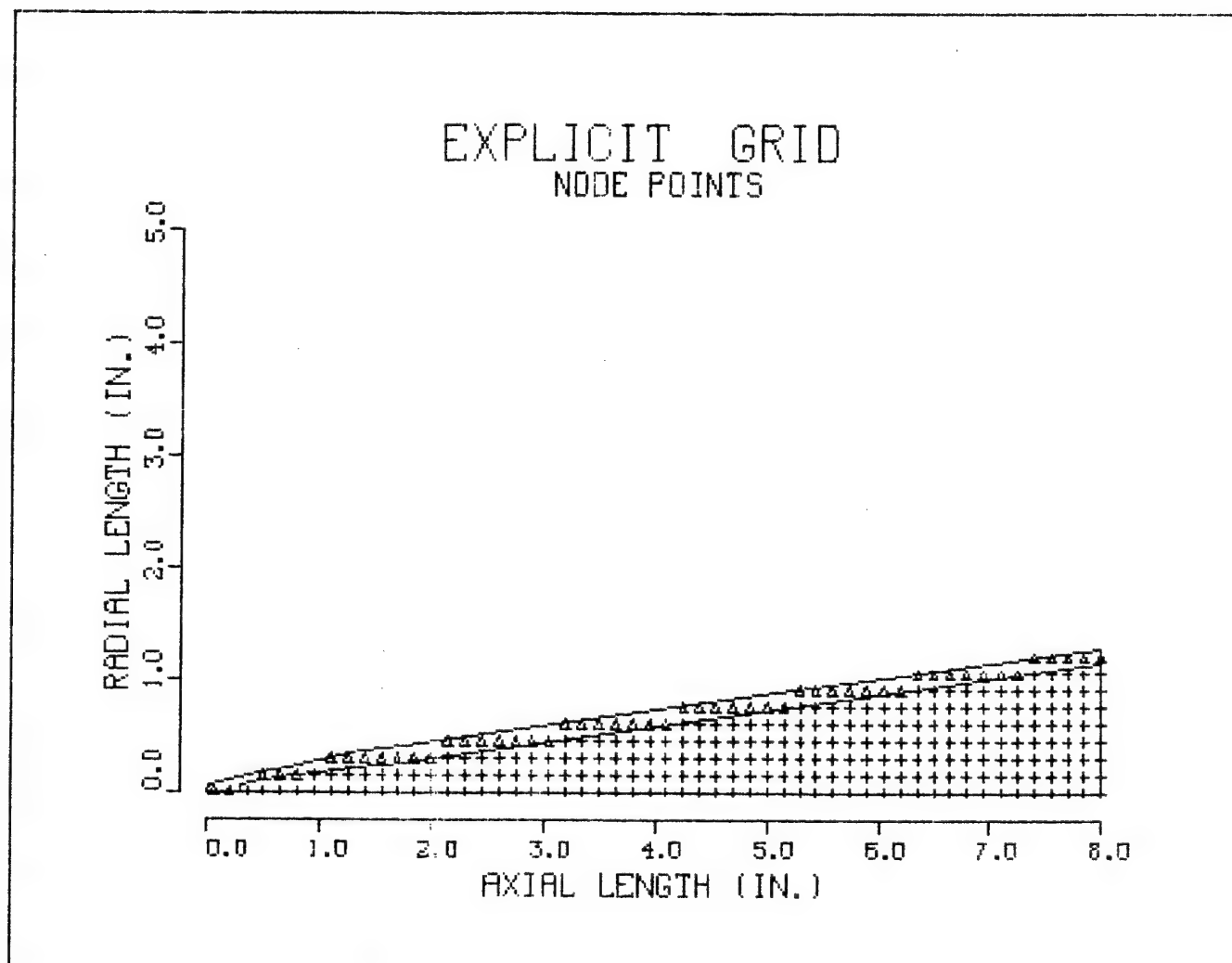
S  
 INTEGER VARIABLES: IL =55 NO. OF AXIAL VALUES  
                     JL =11 NO. OF RADIAL VALUES  
 UNIFORM EXPLICIT GRID: XDIF = 0.15000      GRID STEP SIZE

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S => SHOW	P => PLOT	R => RETURN
C => CHANGE	I => INSERT	D => DELETE
H => HELP		

Modify:

R

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
MODIFY COMMANDS: MSUR MIMP MEXP MINT  
GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND

ZOOM

CURRENT WINDOW COORDINATES ARE:

ZLEFT= 0.00 ZRITE= 8.00 RBOT= 0.00 RTOP= 2.70

ENTER NEW COORDINATES

1.0 3.0

0.0 0.5

#### 2.4.2.5 Modifying the General Interface Locations

In subsection 2.4.2.1, the plot of the interface locations using PINT showed a small discrepancy in the interface definitions. In this section, the small gap between materials 1 and 3 was corrected. It was found that the radii of points 12 and 31 did not match, therefore point 31 was Changed and the new interfaces were Plotted. The user then completed the session by using SAVE to create a new geometry file with all corrections included.

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:  
 PLOT COMMANDS: PSUR PIMP PEXP PINT PALL ZOOM  
 MODIFY COMMANDS: MSUR MIMP MEXP MINT  
 GENERAL COMMANDS: HELP SAVE UPDT NOPR PRMT HALT

COMMAND  
 MINT

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS  
 S =< SHOW P =< PLOT R =< RETURN  
 C =< CHANGE I =< INSERT D =< DELETE  
 H =< HELP

MODIFY:

S

VARIABLES: NIF= 33 NO. OF INTERFACE POINTS

INTERFACE LOCATIONS:

N	RIS	ZIS	NBS
1	0.0000	0.0000	1
2	0.0605	0.0010	1
3	0.1050	0.2000	1
4	0.1603	0.4500	1
5	0.2157	0.7000	1
6	0.2822	1.0000	1
7	0.3375	1.2490	1
8	0.3798	1.5500	1
9	0.4250	1.8750	1
10	0.3200	1.9400	1
11	0.2910	1.7600	1
12	0.2260	1.7600	1
13	0.1571	1.2680	1
14	0.0775	1.2680	1
15	0.0775	0.8600	1
16	0.0000	0.8600	1
17	0.0000	0.0000	1
18	0.0000	0.8600	2
19	0.0775	0.8600	2
20	0.0775	1.7600	2
21	0.2910	1.7600	2
22	0.3200	1.9400	2
23	0.4250	1.8750	2
24	0.4712	2.2000	2
25	0.8788	5.1000	2
26	1.2863	8.0000	2
27	0.0000	8.0000	2
28	0.0000	0.8600	2
29	0.0775	1.2680	3
30	0.1571	1.2680	3
31	0.2157	1.7600	3
32	0.0775	1.7600	3
33	0.0775	1.2680	3

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S =< SHOW

P =< PLOT

R =< RETURN

C =< CHANGE

I =< INSERT

D =< DELETE

H =< HELP

MODIFY:

P

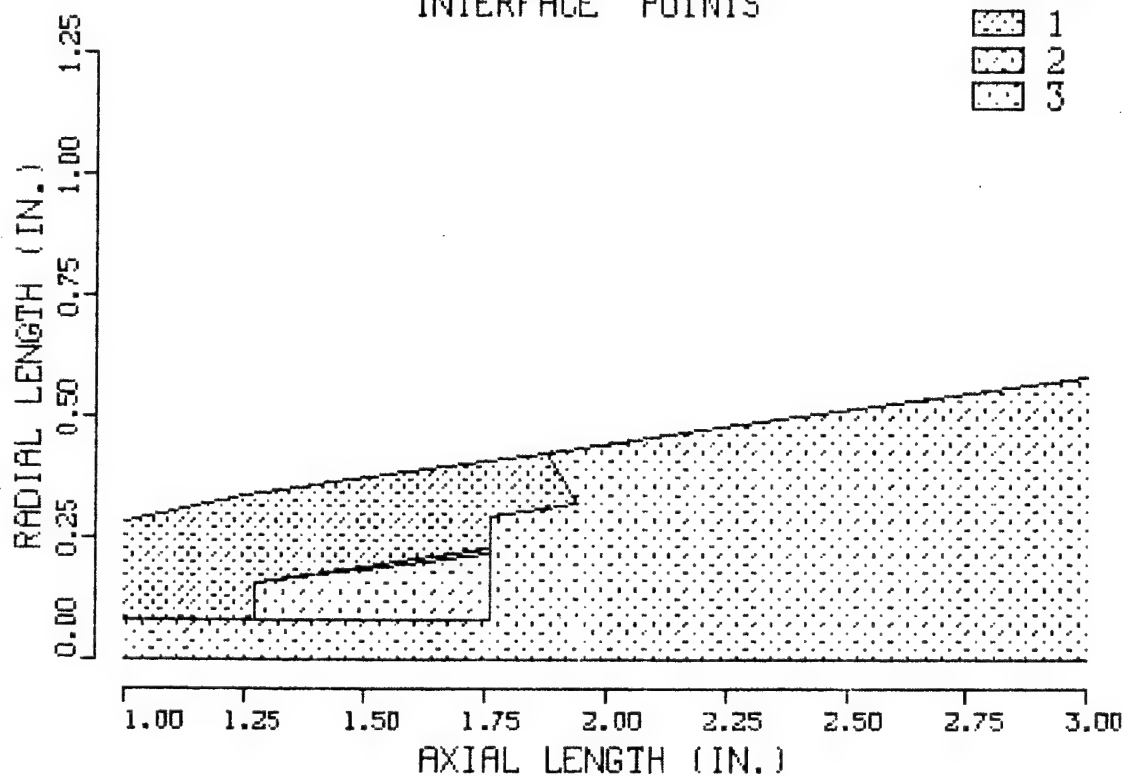
# GENERAL MATERIAL INTERFACE POINTS

MAT NO.

1

2

3



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S =< SHOW

P =< PLOT

R =< RETURN

C =< CHANGE

I =< INSERT

D =< DELETE

H =< HELP

MODIFY:

C RIS 31 .2260

PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S =< SHOW

P =< PLOT

R =< RETURN

C =< CHANGE

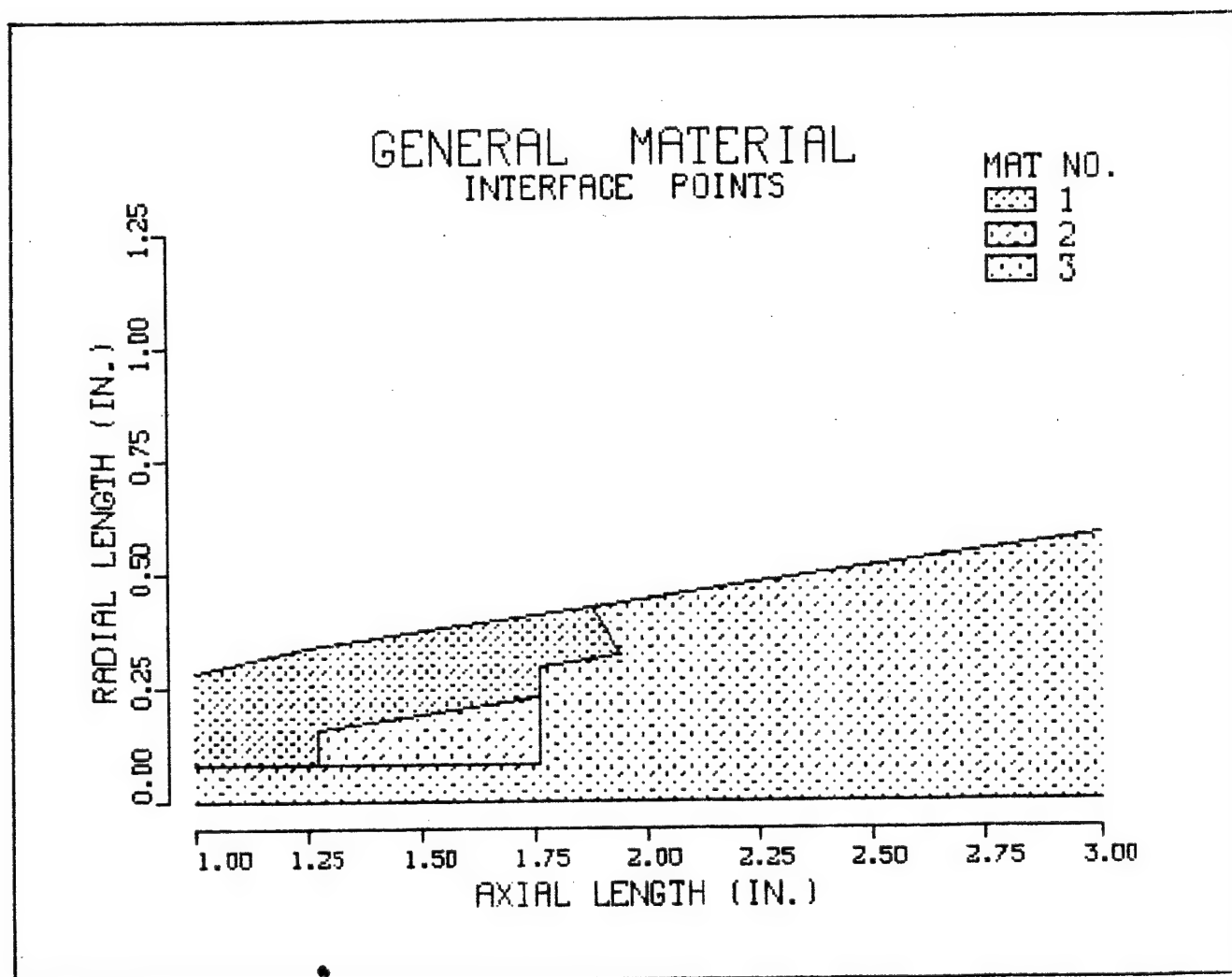
I =< INSERT

D =< DELETE

H =< HELP

MODIFY:

P



PLEASE SELECT ONE OF THE FOLLOWING MODIFICATION OPTIONS

S =< SHOW	P =< PLOT	R =< RETURN
C =< CHANGE	I =< INSERT	D =< DELETE
H =< HELP		

MODIFY:

R

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINT	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	UPDT	NOPR	PRMT	HALT

COMMAND

NOPR

COMMAND

ZOOM

CURRENT WINDOW COORDINATES ARE:

ZLEFT= 1.00 ZRITE= 3.00 RBOT= 0.00 RTOP= 0.50

ENTER NEW COORDINATES

0.0 8.0 0.0 2.7

COMMAND

PRMT

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINT	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	UPDT	NOPR	PRMT	HALT

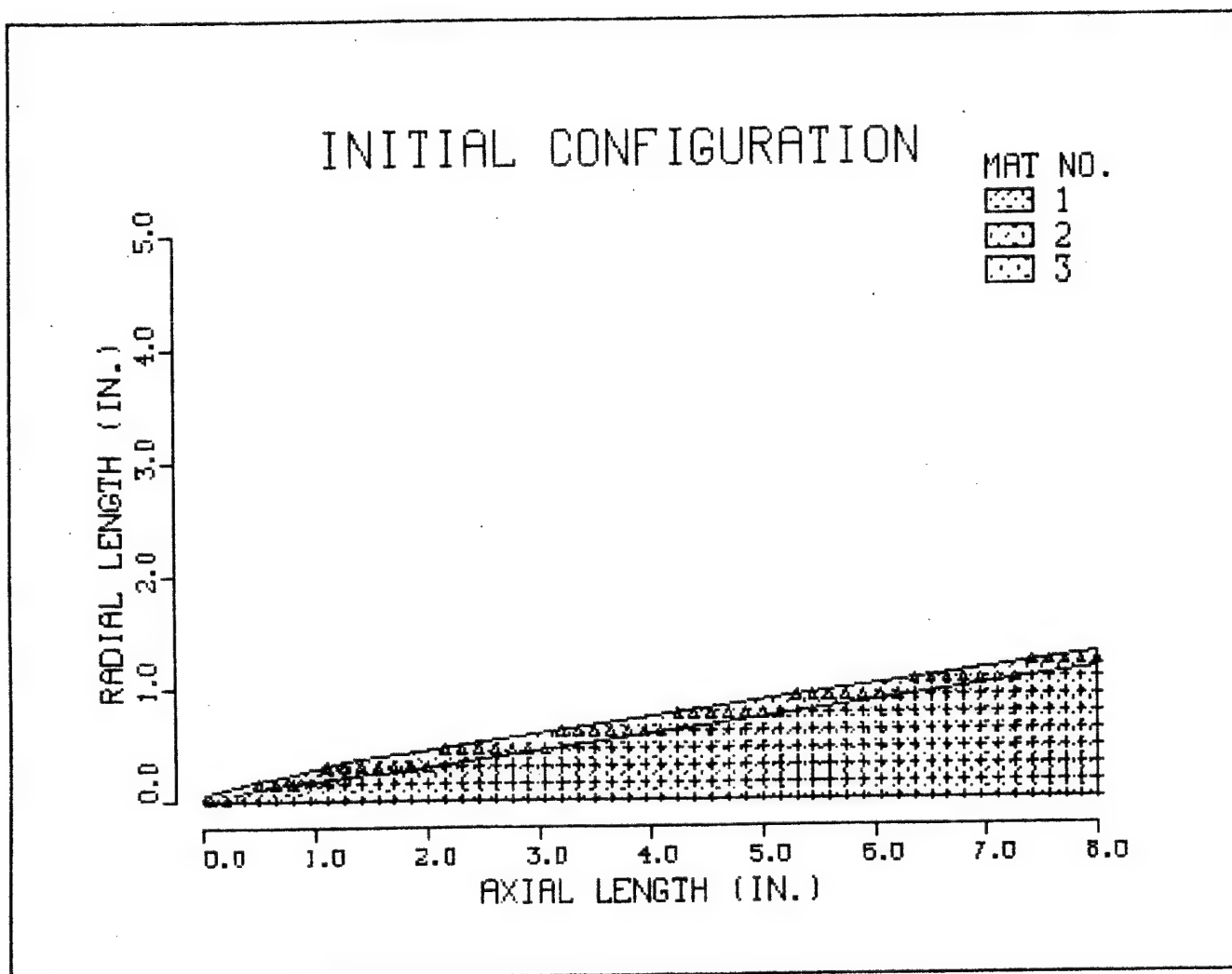
COMMAND

SAVE

PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINT	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	UPDT	NOPR	PRMT	HALT

COMMAND  
PALL



PLEASE SELECT A COMMAND FROM THE FOLLOWING LIST:

PLOT COMMANDS:	PSUR	PIMP	PEXP	PINT	PALL	ZOOM
MODIFY COMMANDS:	MSUR	MIMP	MEXP	MINT		
GENERAL COMMANDS:	HELP	SAVE	UPDT	NOPR	PRMT	HALT

COMMAND  
HALT

END OF DISSPLA 9.0 -- 27308 VECTORS GENERATED IN 15 PLOT FRAMES.  
 PROPRIETARY SOFTWARE PRODUCT OF ISSCO, SAN DIEGO, CA.  
 8295 VIRTUAL STORAGE REFERENCES; 4 READS; 0 WRITES.  
 FORTRAN STOP

### 2.4.3 New BRLASCC Table 3

\$ EDT NEWGEOM.PCH

```

03      BRL FLIGHT CASE (YUMA TS=125 DEG-F, TO=60 DEG-F)
-12      0      0
0.60000E-01 0.00000E+00 P.00000E+00 2.2000      585.00      200.00
0.00000 0.00000 1
0.00100 0.06050 1
0.20000 0.10500 1
0.45000 0.16030 1
0.70000 1.21570 1
1.00000 0.28220 1
1.24900 0.33750 1
1.55000 0.37980 1
1.90000 0.42900 2
2.20000 0.47120 2
5.10000 0.87880 2
8.00000 1.28630 2
33
0.00000 0.00000 1
0.00100 0.06050 1
0.20000 0.10500 1
0.45000 0.16030 1
0.70000 1.21570 1
1.00000 0.28220 1
1.24900 0.33750 1
1.55000 0.37980 1
1.87500 0.42500 1
1.94000 0.32000 1
1.76000 0.29100 1
1.76000 0.22600 1
1.26800 0.15710 1
1.26800 0.07750 1
0.86000 0.07750 1
0.86000 0.00000 1
0.00000 0.00000 1
0.86000 0.00000 2
0.86000 0.07750 2
1.76000 0.07750 2
1.76000 0.29100 2
1.94000 0.32000 2
1.87500 0.42500 2
2.20000 0.47120 2
5.10000 0.87880 2
8.00000 1.28630 2
8.00000 0.00000 2
0.86000 0.00000 2
1.26800 0.07750 3
1.26800 0.15710 3
1.76000 0.22600 3
1.76000 0.07750 3
1.26800 0.07750 3
1 8.0000      0.00000E+00
6 12
0.20000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00 0.30000E+00
0.30000E+00 0.25000E+00 0.16000E+00 0.15000E+00 0.15000E+00 0.15000E+00
55 11
0.15000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00 0.00000E+00
Command: EXIT

```

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